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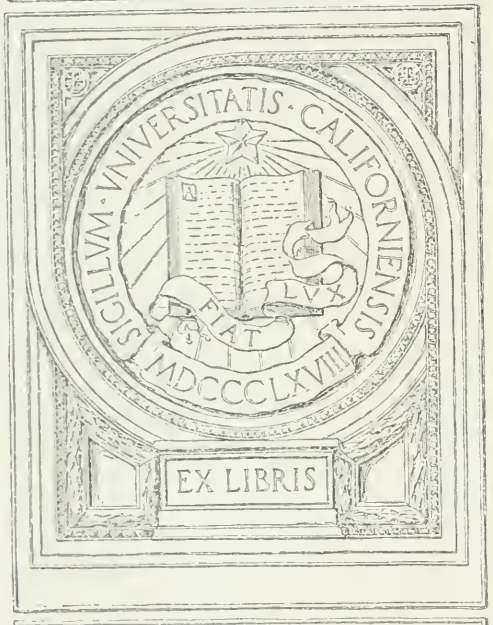

DAVID NAPIER

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Engraved by G. Hunt.

A TRIP UP LOCH LOMOND.

Pub. Jan.y 1825. by Pyall & Hunt. 13. Tavistock St.t Cov.t Garden.

DAVID NAPIER

ENGINEER

1790–1869

An Autobiographical Sketch with Notes

"By hammer and hand our Art over all Arts doth stand"

(*Motto from a Snuff-box that belonged to David Napier*, 1808)

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NOTE

The Introduction, including the particulars of my grandfather, David Napier's life and matters relating thereto, as well as the Notes, have been gathered together by Mr. David Bell of 16 Eton Place, to whose labours I am indebted for whatever is of interest beyond the Memoir itself.

DAVID DEHANE NAPIER.

Glasgow, *May*, 1912.

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Introductory

The marvellous development of manufactures, trade and commerce during the past century has been due so directly to the improvement of the steam-engine, and the establishment of steam navigation, that a special interest attaches to the Memorials of those who were the pioneer workers in these departments of industry. The steam-engine as a prime mover is a comparatively modern invention,—dating no further back than the end of the seventeenth century,—and recognised as having had its real origin in the ingenious devices associated with the names of Morland, 1682, Papin, 1685, and Savery, 1696. The arrangements introduced by these inventors, although of a simple nature, marked a distinct advance. Prior to their time the only application of steam to what could be reckoned useful work consisted in simply letting its pressure act directly upon the surface of water confined within a closed chamber or vessel, thereby forcing the water through an outlet pipe to a higher level. Then followed the introduction of a "floater" upon the surface of the water to lessen condensation, the duplicating of vessels to obtain a continuous discharge from their alternating pressures, and other mechanical arrangements more or less ingenious, but without the necessary efficiency to rank them as prime movers.

The steam-engine properly so called, although in rudimentary form, came into view about 1690, when the important stage was reached of using a piston working in a cylinder, and adopting means

for condensing the steam that had pressed the piston upward in order to make the return stroke by atmospheric pressure. These ideas were definitely recognised by the distinguished inventors named above, but the mechanism they designed and employed was still of too rude a character to constitute an effective engine even for pumping purposes. Having complete knowledge of what, to this point, had been accomplished, and profiting by the experience of the earlier engineers, Newcomen, aided by Savery and others, next took up the work of improvement, and their patent of 1705 marked a distinct and important step in the effective application of steam to industrial and commercial uses. The engine resulting under this patent formed a connecting link between the primitive steam-pump and the modern engine; and it was recognised as, undoubtedly, "the simplest and most powerful machine that had hitherto been constructed." It was welcomed as meeting a universal want, and within a few years engines of this type had found their way into the industrial areas of Europe and America. The Newcomen proved of special value in the development of mining, and it gave an immense impulse to the promotion of industrial activity in manifold directions. From its simplicity of construction and consequent durability the atmospheric engine was not readily displaced. It continued in use, particularly in connection with mining, long after the Watt engine had been introduced; and the later examples remained at work until about two hundred years after the first specimens had appeared. (See Note 3.)

The growth of mechanical engineering as a profession, consequent on the rapidly increasing demand for engines and other machinery, resulted ere long in producing a numerous body of skilled engineers, many of whom were men of distinguished ability, whose efforts did much to improve the details and increase the efficiency of the atmospheric engine. For sixty or seventy years, however, its radical defects remained uncorrected, and these defects,—the single steam-stroke, and condensation within the cylinder,—rendered it quite insufficient

for much of the mechanical work that was now waiting to be done. Pickard's application of the crank to the steam-engine, 1780, must be noted as an improvement of the greatest importance. This was the general position till Watt's remarkable series of investigations and inventions, 1765-1785, resulted not only in the Newcomen's deficiencies being remedied, but in the design and mechanism being so rearranged and improved throughout as to give the engine, as a prime mover, its practically perfect development. The incomparable excellence of Watt's machine,—its efficiency, economy and range of usefulness,—could not fail to be immediately recognised, and by the end of the century it had come into extensive use. This engine has been universally and justly acclaimed as the most potent factor in the development of industrial and commercial enterprise, and as having contributed more to the world's progress and prosperity than any other invention.

The next great step, the application of steam to the propelling of ships, was at an early date seen to be an object of the utmost importance, but was found to be a task impossible of actual accomplishment during the earlier period of steam-engine development. Steam navigation has its separate history,—one of unique interest,—although it may in truth be regarded as little else in fact but an expansion of the history of the engine itself. The inadequacy of muscular power, and the impossibility of controlling wind-force for safe and speedy navigation, had been obvious from the earliest times. All that could be thought of, however, during the preceding centuries, was the directing of these natural forces to the best advantage by the intervention of mechanical means, such as capstans driven by manual or animal power to operate oars or paddles, or by methods of water-ejection, produced by hand or wind-driven pumps. It illustrates curiously the slowness of mechanical progress to find that some of these primitive appliances remained in use, and even formed the subject of fresh patents, eighty to ninety years after the Newcomen engine had been introduced. The

earliest projectors of the steam-engine however were quick to recognise that it, and it alone, would prove to be the agent capable of furnishing the more powerful motive-force necessary.

Apart from suggestions of earlier date, it is of interest to note that in 1699 Papin proposed that his simple piston engine should be used to drive paddle-wheels, and it is recorded that a few years later he himself fitted a steam-engine to a model boat. The pamphlet published by his contemporary Savery in 1698, "Navigation Improv'd," describes an "engine" which he thought might be "very useful to ships," but this was simply a capstan, wrought by hand, to drive revolving paddles or oars. The propulsion of boats by the steam-engine having however been definitely proposed by Papin, the statement is no doubt justified that the idea or conception of the steamboat was "coeval with the engine itself." Hence it cannot, in strictness, be admitted that any later worker in this field should be regarded as the "original" inventor of steam navigation, although it would appear that in certain cases of later date the propulsion of boats by steam did suggest itself without prior knowledge of what others had proposed. The production of a practically successful steamboat however was, in Papin's time, still a hundred years distant, as, notwithstanding the innumerable efforts subsequently put forth, this achievement proved to be impracticable until the new and improved type of steam-engine necessary had been evolved. Newcomen's engine, so serviceable for many purposes, was found to be ill-adapted for use on board ship, and it had indeed been at work on land for about thirty years before Jonathan Hulls ventured to propose its application to the propelling of a boat.

Hulls, the son of a village mechanic, was born at Aston Magna in 1699. His patent for the application of steam to boat propulsion was taken in December, 1736, and was followed next year by a pamphlet containing an abstract of the patent, with descriptive notes. This he called a "small Treatise to demonstrate the possibility and probability of the matter undertaken," claiming that the scheme

THE Steam Boat Marion ON LOCHLOMOND,

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— Designed & Engraved by H. Wilson 91 Argyle Street Glasgow —

"MARION" SAILING BILL.

From original in Kelvingrove Museum.

he proposed was "practicable, and if encouraged would be useful." The pamphlet contained the well-known sketch of a stern-wheel tug-boat, fitted with an atmospheric cylinder "in the same manner as Mr. Newcomen's engine." This "machine," however, as was shown by the experiments of many subsequent workers, could neither be applied advantageously to a boat nor supply the power required for useful work. Rushen's *History*, 1899, suggests somewhat vaguely that an actual vessel was tried, but adds "tradition says it was a failure and nothing more was heard of it." It is still, however, claimed on behalf of Hulls that, as the foresaid treatise gives the "plan of a Steamboat," he should be acknowledged as "first inventor" of steam navigation. This claim, like others of the same kind, may be reasonably disputed, but honour must be freely rendered to Hulls' ingenuity and enterprise. His proposal however cannot be said to have been the first; it did not embody the elements necessary to success; nor can it be regarded as having furthered in any practical way the introduction of steam navigation.

The next movement of importance, nearly twenty years later, was the offering of a prize by the French Academy for a paper on the "best means for impelling vessels without wind." The successful competitor, Daniel Bernouilli, suggested a series of wheels, with inclined planes or floats, wrought by a shaft on each side of the vessel, and he further proposed a method of jet-propulsion. As respects the motive power however his opinion was that the best engine then known,—the Newcomen,—was "no better than some other forms of motor." The views of so distinguished a scholar reflected no doubt the most intelligent ideas of his day on the subject, yet they suggested nothing of positive value, and merely went to emphasise the continued want of a better engine. It seems probable however that this public enquiry and pronouncement may have had the effect of directing attention more widely to the unsolved problem of steam propulsion, which, from the rapid spread of industrial and commercial enterprise, was now assuming great

importance. A further stimulus was no doubt supplied about this time by the lively interest awakened in Watt's engineering inventions. Whatever the cause, it is noteworthy that from this point the steamboat question was taken up very earnestly by a succession of eager and sanguine inventors, alike in Europe and America. They all however encountered many disappointments, and it was not until after many years of laborious effort that the goal was reached. The amount and variety of the experimental work carried out during the latter half of the eighteenth century marks that as perhaps the period of greatest interest in the introduction of steam navigation; and a general idea of the nature and scope of the pioneer work of this time may be gathered by recalling some of the names more prominently associated with the steamboat enterprise.

1759-64. J. A. Genevois (Switzerland), published proposals for propelling boats by means of oars or paddles, actuated by springs compressed by an atmospheric engine.

1774-78. The Comte D'Auxiron (France), prepared plans of a steamboat which was tried on the Seine, but the results proved unsatisfactory.

1774-90. Jacques Constantin Perier (France), an eminent mechanic, author of a treatise on the steam-engine, and a member of the Academy of Science, assisted at the above-mentioned experiments. He also made further trials on his own behalf with paddle-wheel steamboats.

1776. William Henry (America), fitted a steam-engine into a paddle-wheel boat.

1776. Bushnell (America), invented a sub-marine or torpedo boat for blowing up ships.

1776-1816. The Marquis de Jonffroy (France), an army officer and distinguished mechanician, was for some time associated with the Comte D'Auxiron. He experimented in 1776 with a steamboat in the river Doubs; in 1782 with a boat 140 feet long, fitted with a single condensing engine, on the Saône; and in 1816 made further

experiments at Paris. Two of his boats had duck-foot paddles, one of them driven by a horizontal engine made in France, and working the paddles through rachet-gear. His experiments failed of success "for want of means and support," France thus losing, as alleged, the honour that was within her grasp, as she had formerly lost that of the introduction of the steam-engine in the time of Papin. Notwithstanding this, the Academy of Science, in 1840, awarded to the marquis the honour "of having been first to apply steam successfully to navigation," a recognition which opinion elsewhere has not endorsed.

1782-1802. M. Desblanc (France), tried a boat having a horizontal cylinder, giving motion through rachet-gear to wheels forward and aft, carrying endless chains of floats or paddles on each side of the vessel. Experiments were made on the Saône, but without satisfactory result.

1785-98. John Fitch (America), claimed to have conceived the idea of applying steam to boat propulsion before he knew that steam-engines existed. He was undoubtedly one of the most enthusiastic and far-seeing advocates of steam navigation. In 1785 he submitted his proposals to Congress. His first model was fitted with side paddle-wheels; and he also proposed, as Desblanc had done, endless chains carrying blades or floats passing over rollers forward and aft. He experimented further with boats having cylinders up to 16 or 18 inches diameter. The latest of these, a stern-wheel vessel, had a speed of $7\frac{1}{2}$ to 8 miles per hour, and plied on the Delaware about 1788-90, steaming in all, it is said, over two thousand miles. Fitch further tried a boat with a screw propeller at New York in 1796.

1785-92. James Rumsey (America), after trying a boat propelled by mechanism operated by manual power, proposed a steam-engine and a pump to eject water astern. He claimed to be the inventor of the steamboat, a claim strongly resented by Fitch. Having in 1788 gone to England he arranged to have a boat built, but died in 1792

before it was completed. When tried next year on the Thames it gave a speed of four knots per hour, and the project was then abandoned.

1790-97. Samuel More (America), built a stern-wheel boat, driven by an engine of his own construction, also a side-wheel steamer, and tried many arrangements of machinery for boat propulsion.

1794-1807. Robert Fulton (America), appears to have taken up the subject of steam propulsion about 1794. After carrying out a number of experiments in France, he finally succeeded in establishing steam navigation in America in 1807. (See Note 6.)

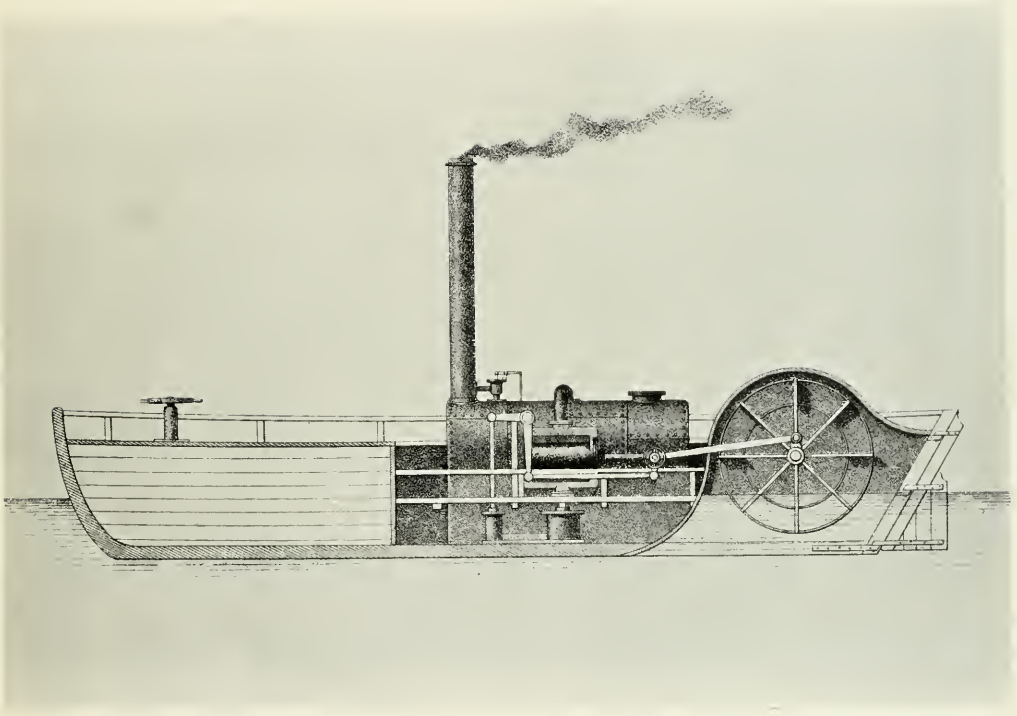
1797. Chancellor Livingston (America), in conjunction with Mr. Nisbet, undertook the construction of a steamboat, which was unsuccessful. He subsequently became associated with Fulton in his experiments.

During the time that these efforts were being made in other countries, Britain likewise had been taking a prominent, and latterly a successful, part in working out the problem of steam navigation. Watt, about 1770, suggested a form of screw propeller for boats, to be driven by a steam-engine, but he allowed the subject to drop, and for many years looked upon the propulsion of boats by steam as impracticable.

1778-80. Matthew Wasborough and John Pickard introduced the crank, to supersede the rachet-gear previously in use, and thereby did much to adapt the engine for boat propulsion.

1785-1801. Joseph Bramah suggested a mode of propelling vessels by an improved rotatory engine driving paddle-wheels or a screw propeller. Woodcroft states that Bramah's was the best mode of steam propulsion that had till then been suggested.

1785-89. William Symington, in 1787, patented an improved atmospheric engine, which it was proposed to employ "to work boats or ships." This engine was so applied in two double-hulled paddle boats belonging to Patrick Miller in 1788 and 1789. (See Note 9.)



"CHARLOTTE DUNDAS."

From Woodcroft's "Origin and Progress of Steam Navigation."

1787-88. Fourness and Ashworth are said (*Trans. Brit. Assn.* 1853) to have made experiments about 1787 in the propulsion of vessels by steam power, and to have built two paddle-boats which gave satisfactory results. In 1788 they patented "a new invented machine for the working, driving or rowing of ships,"—this being an atmospheric engine of peculiar construction, which no doubt was the engine used in their vessels.

1790-1795. The Earl of Stanhope patented inventions bearing upon steam navigation, and experimented with a vessel fitted with duck-foot paddles under her quarters.

1790-1812. Henry Bell took an active part in advocating the adoption of steam navigation. In 1800 he experimented with a small steamboat. In the same year and on a later occasion he urged upon the British Admiralty the use of steam-power in the Navy. His steamboat *Comet* was successfully set to work on the Clyde in 1812. (See Note 5.)

1793-99. Dr. E. Cartwright devised a steam-barge, which in 1799, it is said, he explained to Fulton and gave him the plan or model of it.

1801. Wm. Symington, in 1801, patented a direct-acting engine; and, on behalf of Lord Dundas, designed and engined the *Charlotte Dundas* stern-wheel steamer, which in practical service proved entirely successful. (See Note 9.)

A writer on the history of naval development claims that Miller and Symington, in their boats of 1788 and '89, "made the first really conclusive practical experiments." The engines of these boats, however, having been of the atmospheric type, and cumbered with the old ratchet-gear, could not give permanently satisfactory results; and it appears more reasonable, as is generally agreed, to recognise the *Charlotte Dundas* as the "first practical steam vessel."

Notwithstanding the vast expenditure of skill and labour so briefly outlined by these notes, it is to be observed that practical success was impossible so long as engines—even the latest and most improved—

of the atmospheric type were used. This failure was mainly due to the imperfect nature of the mechanism employed for the transmission of motion from the piston to the propeller. It needed the double steam-stroke condensing engine, as applied in the *Charlotte Dundas* and the *Clermont*, to solve finally the question of boat propulsion. These are justly reckoned the first practically efficient steam vessels,—their success directly due to the new type of machinery,—and the era of steam navigation therefore, alike in the old world and the new, must be held as dating from the opening years of the nineteenth century.

Symington's engine,—the 1801 patent,—possessed every essential qualification which even at the present day is found necessary for marine purposes, but the embargo foolishly placed upon the *Charlotte Dundas* brought his work on steamboats to a premature close. The confidence inspired by the success of that vessel however was shown by the Duke of Bridgewater engaging him to build a number of boats of the same type. The order unfortunately lapsed through his Grace's death, and as Symington could find no other patron to assist him financially, it may be recognised as certain that these obstacles had the effect of delaying the introduction of steam navigation in Europe for commercial service by at least ten years. Meanwhile Fulton, more fortunate in being substantially assisted, and profiting by a thorough knowledge of the experimental work previously done in his own country and in Scotland, was enabled to carry out preliminary experiments in France, and in 1807 to reach his practical success in America. Holmes, an authority on the early history of steam navigation, observes that "although the honour of having first successfully applied steam to the propulsion of vessels is due to Great Britain, to the United States belongs the credit of having been the first to recognise the value of the new invention, and of having first employed it commercially."

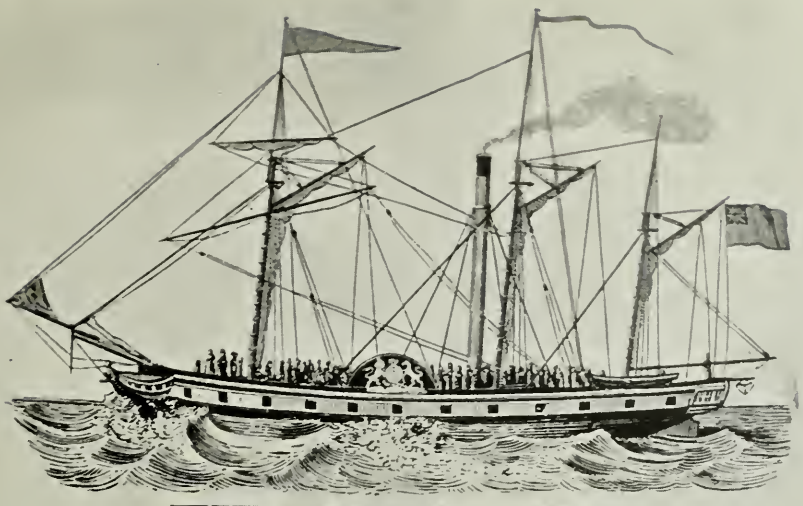
The next development in Britain was with Henry Bell's *Comet* and the steamboats that closely followed her on the Clyde. The

performances of these boats gave more decided promise of the manifold advantages to be expected from the new system of navigation, and led, ere long, to a demand for and supply of vessels of increasing size and speed. This involved important changes in shipbuilding and engineering, and a new departure in the commercial aspects of shipping traffic. The opportunity had now come for men of enterprise to find the capital to build, and the routes in which to employ, the now successful steamboat. The shipbuilder also was called on to furnish vessels of unfamiliar type, fit to withstand the weights and strains of heavy machinery, and the engineer had to undertake the construction of engines, boilers and propelling apparatus for which his previous engineering experience gave but little guidance.

II

David Napier

David Napier was among the first to adopt marine engineering as a distinctive profession, and he was the first in Britain to undertake the development of steam navigation on a large scale. His name, as stated in the *History of Merchant Shipping*, is "more associated than any other in Great Britain with the early development of the marine engine"; and another authority refers to him as "the greatest pioneer of deep-sea steam navigation." It will be seen from the following pages that the circumstances of Napier's youth brought him into contact with the first beginnings of the steamboat enterprise. As a boy he had visited and examined the famous *Charlotte Dundas*, giving special heed to the details of her machinery; and one of the responsibilities laid upon him, when he became manager of his father's foundry, was the construction of a boiler for the historic *Comet*. Following his connection with this pioneer steamer, he was an interested observer of the immediately succeeding experiments by which it was sought to establish steam navigation on the Clyde. His observations led him, ere long, to the conclusion that steam power could be applied more efficiently than had yet been done to the propulsion of vessels, and he foresaw that important and far-reaching results might be expected to follow. His father's death, when he was but twenty-three years of age, left him free to follow his own bent, and decide what his future course was to be; and within two years thereafter he had resolved to



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PORT PATRICK,	0 0 0	1 1 0	1 11 6	1 1 0
ISLE OF MAN,	1 1 0	0 0 0	0 17 6	1 10 6
LIVERPOOL, - -	1 11 6	0 17 6	0 0 0	2 5 0

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PORT PATRICK,	0 0 0	0 10 0	0 10 6	0 10 0
ISLE OF MAN,	0 10 0	0 0 0	0 9 6	0 10 0
LIVERPOOL, - -	0 10 6	0 9 6	0 0 0	0 10 6

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construct new premises for himself, and make marine engineering his life-work.

The enterprise and sagacity shown by Napier at this time, as in later stages of his career, were inherited qualities that had been very characteristic of his father, John Napier (1752-1813), a man of distinct ability. John was the eldest child of Robert Napier and Jean Denny, of Dumbarton, several of whose descendants in different branches became prominent in engineering and shipbuilding. He was twice married, David being the second child of the second marriage. His business, which prospered from year to year, included ironfounding, smith-work and light engineering; and he was recognised as not only industrious and public spirited, but possessed of a strongly marked individuality and force of character. He was enrolled a burgess of his native town in 1775, and elected to its Town Council in 1790. In 1800 he became a member of the Incorporation of Hammermen in Glasgow, in 1807 was appointed collector, and was elected to the office of deacon for the year 1809-10.

In the interests of business he found it desirable to remove, in 1802, to Glasgow, his premises there being located in Howard Street. In that year he took part in starting the Philosophical Society of Glasgow, and he was for several years one of its directors. Through business transactions he had become intimately acquainted with Henry Bell, and appears to have been consulted by him regarding his steamboat project. M'Kenzie, in his *Reminiscences*, mentions having heard "Mr. John Napier discussing with Henry Bell his original plans, and joking with him about his *Comet*." It is unlikely that John seriously doubted the feasibility of Bell's scheme, although at that time there were few that believed in it or gave it attention. He agreed at all events to have the boiler made (which John Robertson could not undertake) for the boat that was then in progress; and David being then practical manager of the foundry, it fell to him to carry out this somewhat unfamiliar piece of work.

John Napier's death occurred in July, 1813, one year after the launch of the *Comet*, so that he had the opportunity, and no doubt the satisfaction, of seeing his friend's first steamboat successfully at work. He may possibly have seen also the one or two boats that immediately followed, early in 1813; but he could not anticipate the amazing developments that were so soon to follow, nor the remarkable influence that his own son was to exercise in bringing these developments about. David's career in improving the steamboat and its machinery, and in vastly widening the area of steam navigation, extended over the next half-century, twenty-four years of that time being spent in Glasgow, and the remainder in London.

The histories and publications that deal with the events of that period contain numerous references to his inventions and shipping enterprise, but these notices are necessarily fragmentary, and from the lapse of time it would be impossible to frame a properly connected narrative, valuable historically as such a record might be. It has, under these circumstances, been considered desirable that the short autobiographical Sketch reproduced in the following pages should be preserved, as being a statement at first hand of some interesting features and incidents of Mr. Napier's professional life not appearing elsewhere. This Sketch, it is understood, was prepared by request of the late Mr. Bourne, who had contemplated the production of a volume on the Rise and Progress of Steam Navigation. The extreme brevity of the document at the same time has suggested the propriety of adding various Notes, which it is hoped may serve to explain or illustrate some of its allusions. The date of Mr. Napier's birth, omitted from the Memoir, appears in the Register of the Parish of Dumbarton, as follows:

"1790. Naiper.

David, lawful son to John Naiper and Ann McAlaster, was born 29th October, and baptised 7th November 1790."

"Naiper," it may be observed, was one of the variations of the name in common use at the time here mentioned.

"COMET," 1812.

From Woodcroft's "Origin and Progress of Steam Navigation."

III

Memoir by David Napier

"I was born at Dumbarton on [29th October, 1790], where I was sent to the public school at five years of age, and there acquired a smattering of French and Latin. When I was twelve years of age my father removed his business to Glasgow, where, although I acquired a little more knowledge of the French language, and a little of drawing and mathematics, under Peter Nicholson,[1] the celebrated author on Architecture, my time was almost wholly taken up assisting my father in his business, which was that of a smith and founder. When at Dumbarton he had two steam-engines, one for blowing the cupola and another for boring cannon. At that period nearly all the cannon made in this country were cast at Carron or Clyde Iron Works,[2] and part of those cast at Clyde Iron Works were sent to Dumbarton to be bored. Why my father should have erected a steam-engine and machinery for boring cannon so far distant from the place they were cast at,

[1] See notes following Chapter VIII.

I cannot explain, but such is the fact, as I recollect when I was a boy the engine going night and day, during the war, boring cannon. I allude to this merely to show my early connection with the steam-engine and machinery.

The engine which bored the cannon[3] was of the old original kind, with open cylinder and wooden walking beam. I never served a regular apprenticeship to anything but put my hand to everything, and by the time I was twenty years of age I had the complete charge and control of my father's business in every respect. Shortly after this my father died, and I married Miss Marion Smith, daughter of Mr. Francis Smith,[4] engineer, with whom I had fifteen of a family, six sons and nine daughters, all of whom are alive but three, and some of them have children of their own.

About the year 1812, Henry Bell,[5] who was frequently in the foundry getting castings for buildings he was superintending, hearing of Mr. Fulton's[6] success in steam navigation in America, began to build a small steamer for the Clyde,[7] which, although it was the first steamer that carried passengers for hire in Europe, was not the first steamer in this country.

Independent of the experiments of Mr. Miller of Dalswinton,[8] there was one on the great canal ten years before that date, by Symington,[9] which I recollect seeing at Port Dundas, when I first came to Glasgow in 1803; although then only twelve years of age, having been reared among

Glasgow 12th Feby 1814

£62 - 11 - 11½

Three Months after Date I promise to pay Mr David Napier or order at his Counting house in Glasgow the Sume of Sixty two Pounds 11 Shillings & 11½ pence Sterling value received

Henry Bell

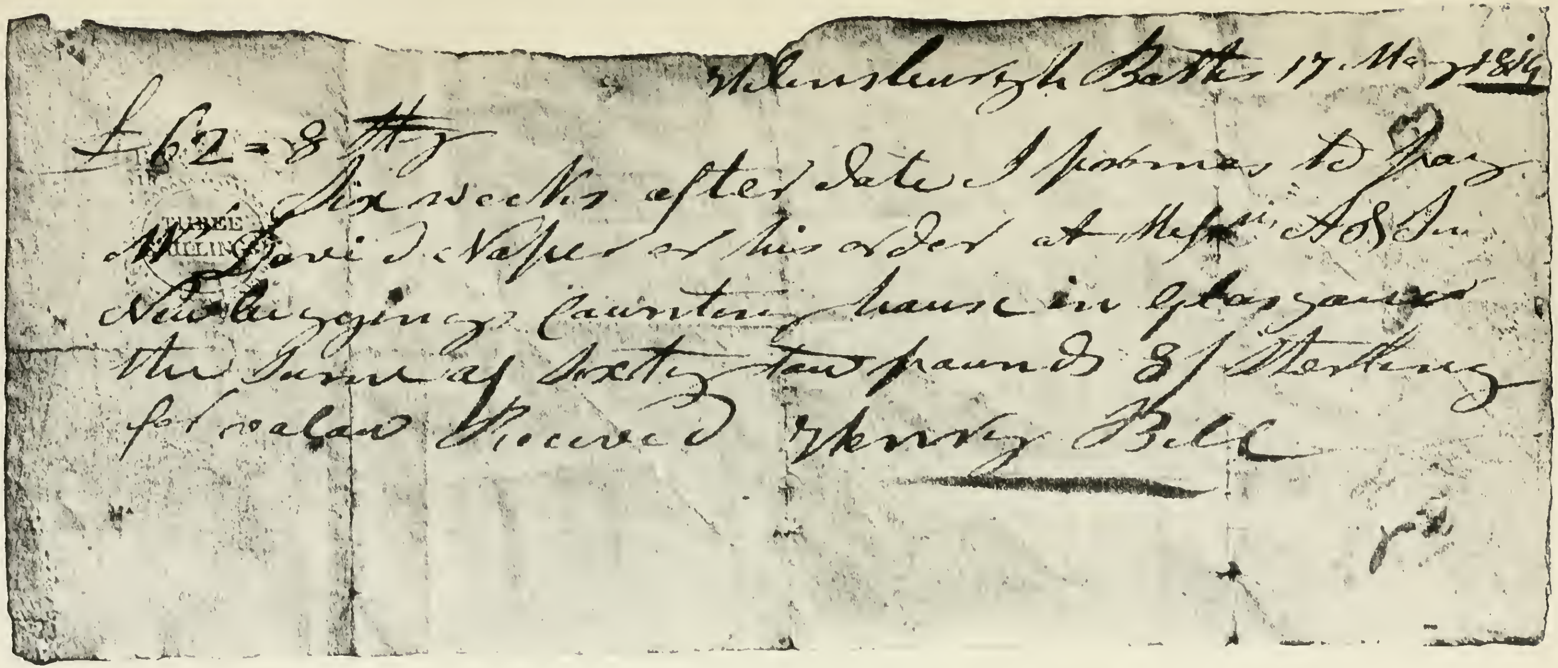
David Napier

engines and machinery, I took particular notice of it. The boiler was a common waggon-shaped boiler, with flues built round it with bricks. The cylinder lay horizontal, and the piston-rod was connected direct to the paddle-wheel in the stern by a long connecting-rod. How very little improvement has been made on that up to the present time. This was about five years before Fulton's steamer, the *Clermont*, commenced running on the Hudson, and ten years before the *Comet* began to run on the Clyde.

I made the boiler and the castings for the engine of Mr. Bell's little steamer the *Comet*, for which he gave me his promissory note, payable at three months, which is still in my possession, never having been paid. I recollect that we had considerable difficulty with the boiler; not having been accustomed to make boilers with internal flues, we made them first of cast iron, but finding that would not do, we tried our hand with malleable iron, and ultimately succeeded, with the aid of a liberal supply of horse dung, in getting the boiler filled. Seeing steam navigation was likely to succeed, I erected new works at Camlachie[10] for the purpose of making steam-engines, where the engines were made for the *Dumbarton Castle*, the first steamer that went up Loch Fyne, and for the *Britannia*,[11] the first that went to Campbeltown. Although these vessels did not venture outside the Cumbraes in stormy weather, they suggested the idea to a Company in

Dublin, of having steamers between Holyhead and Howth, for which purpose two vessels were built at Greenock,[12] no expense being spared to ensure success. The engines were made by Mr. James Cook,[13] at that time the oldest and most respectable engine maker in Glasgow; but when tried on the station they were found so complicated and cumbersome that they broke down almost every gale of wind, and ultimately were laid up in Kingstown Dock, Dublin, as useless; and the idea of making machinery of any kind that would withstand the shock of a heavy sea in a gale of wind was put down as an impossibility.

Whether it was from pique at not having been employed to make the engines of these vessels, or from a conviction that the ocean could be safely navigated by steam, I cannot now say, but I commenced, I think about the year 1818, to build a steamer on my own account for that purpose, called the *Rob Roy*.[14] I recollect the day before starting on the first trip from Glasgow to Dublin, Mr. Charles M'Intosh,[15] the celebrated chemist and inventor of waterproof cloth, saying we should all be drowned. Nevertheless we did start, and although we encountered a gale from the south-west, performed the voyage out and home successfully. I afterwards placed the *Rob Roy* on the station between Glasgow and Belfast, and commenced to build others to run between Greenock and Liverpool, and Holyhead and Howth.

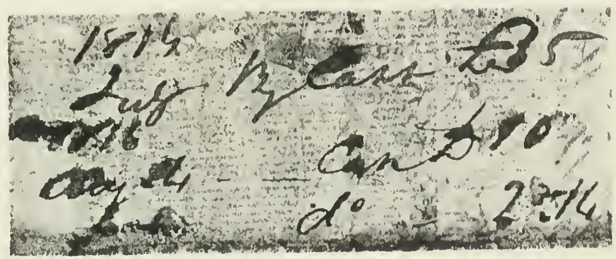


Helensburgh Baths 17 May 1814

£62=8 Stg

Six weeks after date I promise to pay
Mr David Napier or his order at Messrs A & J
Newbiggings Counting house in Glasgow
the Sum of Sixty two pounds 8/ Sterling
for value Received Henry Bell

THREE SHILLINGS



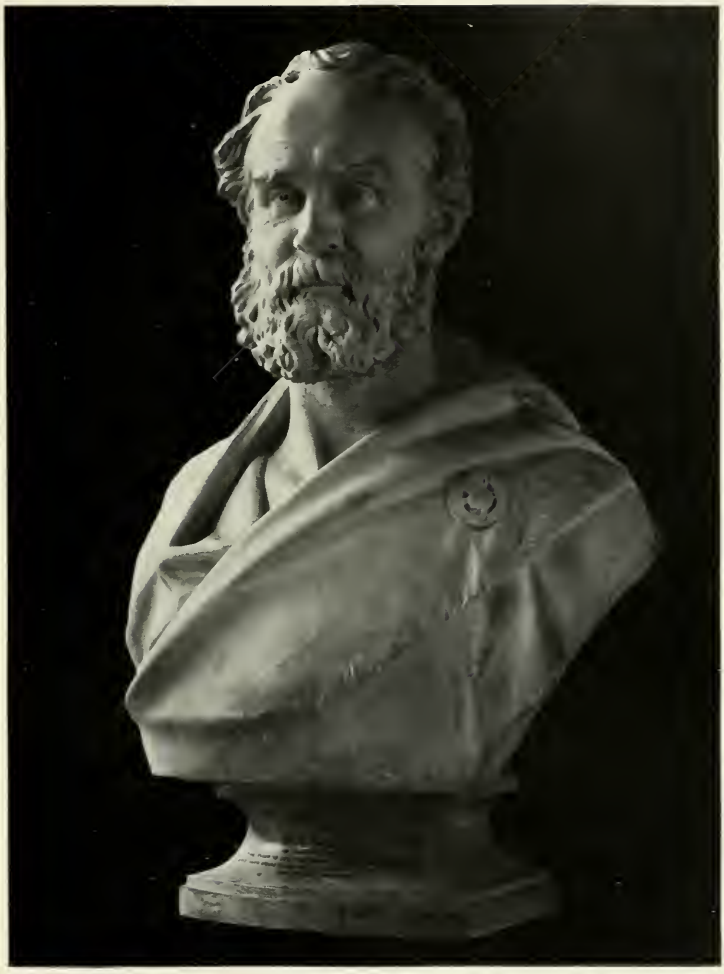
1814 July By Cash £35
1816 Aug 24 Cash £10
Do 2=14

That these were the first vessels that established the practicability of navigating the open sea by steam is recorded in two Blue Books of the House of Commons, the subject having been investigated by a Select Committee on the Holyhead Roads, Sir Henry Parnell, Chairman. The names of the vessels I made for the Holyhead and Howth station were the *Talbot* and *Ivanhoe*, which were so successful as to induce the Government to send down a commission to purchase them, and who offered to take them at their value, with £5000 of a premium besides, which I considered a very handsome offer; but, having assumed some mercantile gentlemen as partners in the speculation, they were so elated with our success that they would not listen to that proposal. The Government were consequently obliged to build vessels themselves to carry the mails, for which they employed Boulton and Watt to make the engines. When these vessels came on the station they were so unfortunate that the Government were obliged to charter the *Talbot* to carry the mails in their stead, and ultimately purchased the *Ivanhoe*.

About this time I placed, on my own account, the first steamer on Loch Lomond.[16] Also, finding it was necessary to put a larger and more powerful steamer than the *Rob Roy* on the Belfast station, I sold that vessel to two gentlemen, holding a third of her myself, to run between

Dover and Calais. The *Rob Roy* was therefore not only the first steamer that proved the practicability of navigating the open sea by steam, but was also the first to connect France and England by steam. Her success there was so complete as to induce the Government again to employ Boulton and Watt to make engines for two steamers for that station, which the little *Rob Roy* so thoroughly beat, particularly in stormy weather, that the French Government took such a fancy to her that they purchased her, that vessel being the first steamer they possessed, and with which they were so well pleased that, with a priest, and some holy water, they formally transformed the Scotch freebooter into a French king, *i.e. Henri Quatre.*

About this time I purchased the land on the north shore of the Holy Loch,[17] which was then in a state of nature, being inaccessible by road from any part of the world. On the shore I built piers for landing, and an hotel,[18] and ran steamers daily to and from Glasgow. I also put a small steamer on Loch Eck, a fresh water lake about equi-distant from Loch Fyne and the Holy Loch, and another across Loch Fyne, and had a road made from the Holy Loch to Loch Eck, on which I placed a steam carriage,[19] thereby making a new route to Inveraray and the Western Highlands. This steam carriage was, I believe, the first that carried passengers for hire on common



DAVID NAPIER.

From bust in Kelvingrove Art Galleries.

roads, being long before there were any public railways in either England or Scotland conveying passengers by steam ; but from the softness and the hilliness of the roads, and more particularly from the want of knowledge how to make a boiler, we could not obtain the speed I expected. But from the experience we now have in making boilers and machinery, I feel so confident that steam carriages can be made to do all the work that is done by horses on common roads, as well as a good deal of what is done by steamboats, at one half the expense, that I have again resumed the subject. Finding that steam navigation was becoming an important business, I purchased lands at Lancefield,[20] on the banks of the Clyde, as being more suitable for the purpose than Camlachie; which premises I let to my cousin, Robert Napier,[21] who, having obtained the assistance of a clever mechanic of the name of Elder, commenced to make engines at my old premises at Camlachie with very great success.

During the latter part of my career, I was very much assisted by two excellent workmen, David Tod and John M'Gregor,[22] who, since I sold Lancefield to my cousin and retired from public business, have been very successful in doing business on their own account. After retiring from business on the Clyde, I purchased land on the banks of the Thames at Millwall, for the purpose of making experiments in steamers. Having in early life satisfied myself

by a temporary experiment on a small steamer, the *Post Boy*, that surface condensation would be of great advantage to steam navigation, the idea occurred to me that the bottom of an iron vessel (that is the bottom of the ship) could be applied for the purpose of condensation; and having obtained a patent, I built the *Eclipse* on that plan, which outsailed all other steamers on the Thames. I afterwards built the *Isle of Thanet*, which far surpassed the *Eclipse*; after that I built the *Rocket*, with two screws on the stern, which I am convinced would be superior in many respects to the single screw which is in general use.

I lately let part of my premises at Millwall to Mr. Scott Russell for the purpose of building a monster steamer, which I expect will turn out the most successful steam speculation that has yet been tried. I cannot, at this distance of time, recollect the various improvements, or more correctly the alterations, I made on steamers. I recollect that they were generally built with a full round bow, which, with a clear run, was considered at that time the best shape for speed; but on perusing the works of Bossut,[23] a celebrated French mathematician, on the resistance of fluids, I began to have serious doubts of the full bow being the proper shape, to prove which I set about a series of experiments, for which a large mill-dam that bounded the premises at Camlachie afforded great facilities.

Having obtained a block of wood of the proportional length, breadth and depth I intended to build the *Rob Roy,* and having erected a frame-work close to the water of considerable elevation, at the top of which was a roller or drum for winding up a weight, the other end of the line being attached to the experimental block, I carefully noted the time the weight took to descend, dragging the block at the same time through the water, and continued fining the bow as long as there was any perceptible increase to the speed, always taking care to put the block into the scales each time I altered the shape, so as to keep the weight of the block the same, which block or model I gave to the shipbuilder to take off his lines for building the *Rob Roy.* When it was launched nautical people said I had put the wrong end foremost; however, when it was tried it was found that they were wrong, and the old boats were put into dock to have their bows sharpened, which was found invariably to increase their speed.

It would be endless enumerating the various alterations I was daily making in the engines and machinery of steamers before I introduced what is generally called the Steeple engine, which, although it was condemned at first, was afterwards almost universally adopted on the Clyde. It would be equally tiresome and uninteresting to enter into details connected with the various patents I afterwards obtained, for which I had the presumption to give

the title of "Improvements on the Steam-Engine," etc. The following enumeration, which were the subject of half a dozen different patents, will suffice: Using the bottom of the ship for the purpose of condensation; a mode of feathering paddles; a mode of applying two screws on the stern; boilers with vertical tubes; engines with four piston-rods; a plan of connecting the crank direct to the piston by means of a slot in the cylinder-cover, which was covered by a sliding stuffing-box; a rotary engine, which I am at present engaged with; and last, although I hope not least, a mode of extracting the heat from the steam during the process of condensation after it has been used in giving motive power, and applying the heat so extracted to the reproduction of steam, by means of the steam passing through a series of very thin flat tubes, over which a current of air is blown, into the furnace, thereby supplying the furnace with heated air, and at the same time condensing the steam; which I expect will be of great value to railway travelling, as it will save the stopping for water on the journey. To prove the utility of this I intend trying it myself in a steam carriage for common roads.

It may appear strange that, after such a long public career, the Government should not have granted me a pension of £1000 a year, or that I have received so very little of the public money in the way of business. Whether

DAVID NAPIER.

From bust in Kelvingrove Art Galleries.

the latter arose from a certain independent spirit or pride that would not allow me to estimate for work, or from an inherent dislike to bribery, which I believe to be very generally pursued in one way or another by those who obtain Government employment, I cannot say; but the following transaction, the only one I ever had with the Government, may throw some light on that subject. A gentleman of Liverpool having taken a fancy to a small steamer of mine, purchased it, and took it to Liverpool; where it suggested to the officials connected with the Mail Packets that something of the kind would be very useful for conveying the mails and passengers to and from the large Packets when they could not get over the bar. I consequently received a letter from Sir Francis Freeling, the Commander-in-chief of the Post Office in London, commanding me to go to Liverpool and meet with certain parties there about a steam tender. Not being accustomed to be addressed in that manner, I had considerable doubts about going; however, I did go, and met with captains of Mail Packets and others, who agreed to whatever I suggested; and a contract was at once entered into, that I was to build a steamer of a certain size for a given price; but I had no sooner returned to Glasgow than I discovered I could make a vessel altogether more suitable for the purpose than that for which I had contracted. I consequently wrote to Sir Francis Freeling to that effect, and

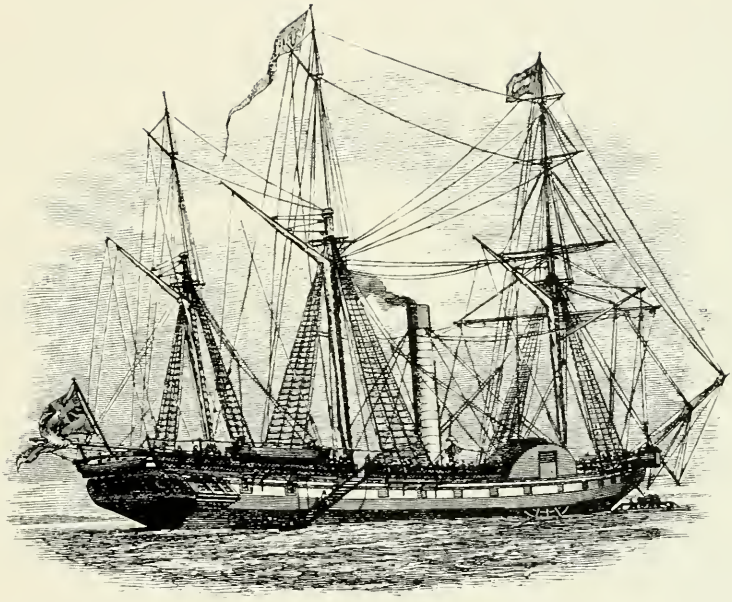
that I would proceed with the vessel, and after it was finished, if it did not please, both as regards price and everything else, they would not be required to take it; to which I received for answer that I must send a description of the alterations I was going to make, and the cost; but, as I might change my plans at the end of a week, and as the one which I had contracted for was in a manner left entirely to myself, I saw no use in being so shackled, and therefore did not comply with that request, which produced a great deal of angry correspondence, and ultimately a Commissioner was sent from London to adjust matters, which ended in nothing but a letter from Sir Francis Freeling's son saying they considered the contract annulled. To which I replied that I did not intend being at all the trouble and expense of going to Liverpool for nothing; and, without letting them know what I was doing, proceeded with the vessel according to my own views.

When finished I wrote to London to that effect, and that the cost was £900 more than what I had contracted for, and that they might either take the vessel or not as they chose, when certain parties were sent down, accompanied by an engineer to examine her, who took her away, and gave me an order for the whole price I asked; and were so pleased with her when she went to Liverpool, being the fastest vessel there, that she was called *Richmond*, after the Duke of Richmond, then Postmaster-General;

but I had no sooner got the money, than I received a hint from certain parties that a percentage of gratuity was expected, it being customary; which I set my face decidedly against, although it was at the risk of never being employed again.

About a year ago, seeing the difficulty of taking Cronstadt and Sebastopol, I wrote to the Admiralty, through the Duke of Argyle, suggesting a gun-boat[24] that would destroy anything that could be destroyed by cannon balls, while it was itself indestructible. The principal feature of it was, that it was not to have any sides above water, only the deck, which would be eighteen inches or two feet thick; the outside of which would be iron plates, one inch thick, and the inside skin plates half-inch thick, and solid woodwork between them. The deck to have a considerable curvature, for the quadruple purpose of giving the vessel greater buoyancy; elevating the aperture or port of the gun, in the bow, out of the water; give more head-room for the men inside; and to make it more difficult for any person to stand on the deck, or shot to damage it. The vessel to be about 100 feet long, and 20 feet broad, with an engine of twenty horse-power, which would impel it at a rate of seven miles an hour. To have an aperture in the bow for a malleable iron gun which would load at the breech, which aperture would be opened and shut at pleasure from the inside by a strong malleable iron

water-tight and shot-proof valve. If desirable there might be more guns than one, placed behind each other, with apertures in the deck. The fan that would supply the boiler furnace with air would cause a circulation through the whole vessel. When the port-hole was shut, air could be admitted by small india-rubber tubes, standing a foot above deck, which would fall down when the sea passed over the deck without admitting water. Such a vessel would live in any sea, there not being a projection of any kind on her surface either on deck or anywhere else but the screw at the stern ; and having had some experience as an amateur in gun-making in my youth, I offered to get a malleable iron gun made, that would load at the breech with perfect safety, and would fire two shots for one of any gun in the Navy balls of one hundred-weight if required, or no pay. I also suggested that a gun of that kind could be mounted on wheels to be used on land, and enclosed in a strong case of iron, narrow in front and wide enough behind to contain half a dozen men to work the gun, and who could move it backwards or forwards at pleasure ; or, one of a large class could have steam to move it. The iron case to be perforated with holes for muskets, so that no one dare approach it. To this letter I received an answer from the Admiralty declining my proposal, without assigning any reason."



"UNITED KINGDOM."

From Lindsay's History.

IV

Business Life in Glasgow

In commencing the business of marine engineering Mr. Napier at the same time made a beginning as an owner of steamboats. His first engine, of twenty horse-power, was fitted into the little steamer *Marion*, a sketch of which (reproduced from an engraving dated 1825, and belonging to Mr. J. M'Phail, 219 Argyle Street, Glasgow, who kindly allowed its reproduction), forms the frontispiece. In the following year he engined two cargo boats, and then took up the question of extending steam-power to deep-sea navigation. This was still reckoned a problem of difficulty and danger; and although steamboats had now been running on the Clyde for about five years, the notion that hulls of sufficient size and strength could be made to carry the heavy and powerful machinery required to propel them safely and in all seasons through stormy seas was still regarded as visionary.

The Memoir alludes to the model experiments—then a novelty—which Napier carried out prior to building the *Rob Roy*, and it refers also, with pardonable pride, to the success of that vessel in "proving the practicability of navigating the open sea by steam." This effort, although on a small scale, was sufficient to inspire confidence among commercial men, and led to the construction without delay of other vessels designed specially for sea-going traffic. These formed the pioneer boats of several important companies, as indicated by particulars that follow; and in these further ventures Mr. Napier

appears to have borne a large share of the financial responsibility. The first steam company to trade between Glasgow and Liverpool was commenced with his steamers in 1819, and other lines were similarly organised under his guidance from time to time thereafter. He likewise from an early date carried on a considerable passenger traffic on the Clyde on his own account, being the first to establish a service to some of the Clyde watering-places, and upon the waters of Loch Lomond and Lock Eck. He made a further effort to extend these local developments by offering to assist a scheme for the improvement of the River Cart, in order that Paisley might have the advantage of regular steamboat communication. The project however did not meet with sufficient public support, and the object aimed at, notwithstanding later efforts, has not yet been realised.

The shipping companies with the building up of which Napier was identified appear to have met with much success. His vessels attracted attention as being the largest and fastest of their time; and within a comparatively short period his reputation as a leading authority in steamship affairs had become well established. An official report of 1822 refers to "Mr. Napier, Engineer, Glasgow, whose skill in the construction of steamboats is allowed to be great. He has also been enterprising and successful, having established the Steam Packets between Glasgow and Belfast, Greenock and Liverpool, Holyhead and Dublin, Dover and Calais." This enumeration affords striking evidence of the amount and value of the pioneer work which Napier had been able to carry through in the first seven years of his engineering career. These earlier achievements led gradually to undertakings not relatively more important but involving work of a heavier description,—larger and improved vessels were provided for the companies already established, and others were built for new lines, such as that between Leith and London. This service was opened in 1826 by the *United Kingdom*, regarded then as the finest steamship afloat; and steamers were also built, or sold, for routes managed at Hull and other ports.

SAILING PACKET.

From original in possession of David Dehane Napier.

Napier at the same time kept up his connection with these vessels, and carried on experiments in them with his improvements.

With the yearly increase of steam navigation many new firms took up the business of shipbuilding and marine engineering throughout Great Britain, but alike in respect of improvements introduced, and of successful results, Napier maintained a leading position to the close of his business career in 1836. On removing then to London his subsequent work was wholly of an experimental character, and his active promotion of over-sea navigation came gradually to a close. His Clyde steamboats were then disposed of, but he continued for many years thereafter to be principal proprietor of the steamers on Loch Lomond, and to hold also a substantial interest in some of the larger shipping companies that he had been instrumental in founding.

As presenting an outline of Mr. Napier's earlier work, by a competent and well-informed writer, the following extract may be found of interest:

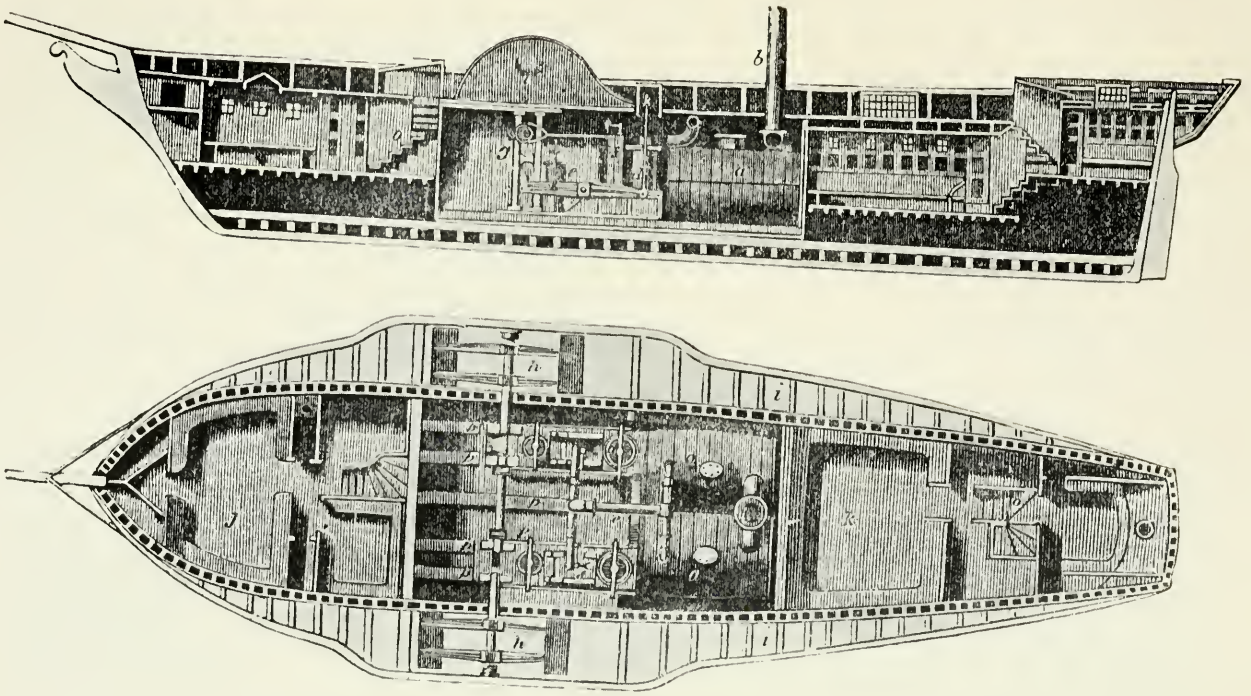
From Mr. John Scott Russell's *Steam and Steam Navigation*, 1841.

"From the commencement of steam navigation in Great Britain, no great stride appears to have been made until the year 1818, when Mr. David Napier, the engineer, entered on the construction and improvement of steam navigation. We believe that from the year 1818 until about 1830 David Napier effected more for the improvement of steam navigation than any other man. It is necessary to distinguish betwixt him and Mr. Robert Napier, whose successful efforts in steam navigation are of later date.

"It is to Mr. David Napier that Great Britain owes the establishment of deep-sea communication by steam vessels, and of Post Office Steam Packets. Previous to his time, steam vessels ventured rarely, and only in fine weather, beyond the

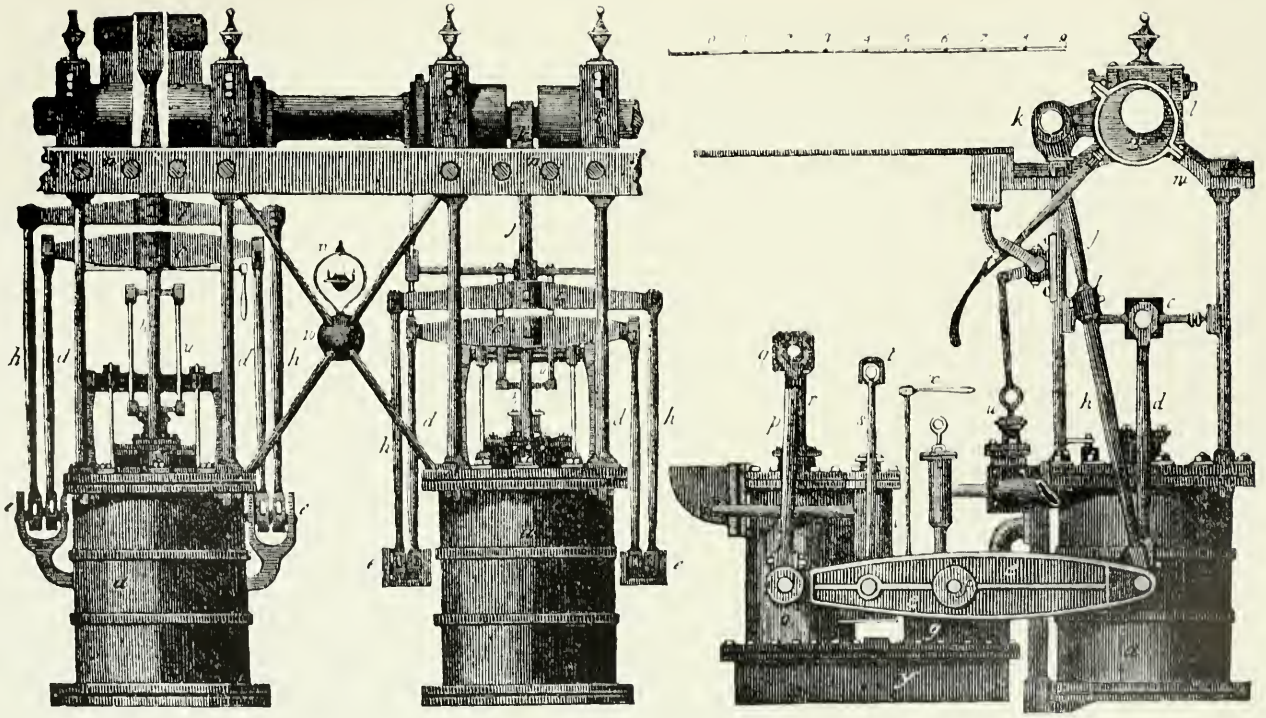
precincts of rivers and the coast of friths. He adventured at once to establish regular communication between Britain and the surrounding countries, Ireland and France, by steam vessels plying even during the stormy months of the winter. It is said that the following is the manner in which he first essayed his arduous attempts. Not long after the introduction of steam navigation on the River Clyde, he had entertained the idea of establishing steam communication on the open sea; and, as a first step, he endeavoured to ascertain the amount of the difficulties to be encountered. For this purpose he took a place, at the stormy period of the year, in one of the sailing packets[1] which then formed the only means of intercourse between Glasgow and Belfast, and which then required often a week to accomplish what is done by steam in nine hours. The captain of the packet in which he sailed remembered distinctly a young man, whom he afterwards knew as Mr. Napier, being found, during one of the winter passages to Belfast, constantly perched on the bows of the vessel, and fixing an intent gaze on the sea when it broke on the side of the ship, quite heedless of the waves and spray that washed over him. From this occupation he only ceased at intervals, as the breeze freshened, to ask the captain whether the sea was such as might be considered a rough one, and being told that it was by no means unusually rough, he returned to the bows of the vessel and resumed his study of the waves breaking at her stem. Some hours after, when the breeze began to freshen into a gale and the sea to rise considerably, he again enquired of the captain whether now the sea might be considered a rough one, and was told that as yet it could not be considered very rough. Apparently disappointed, he returned once more

[1] An illustration of one of the old sailing packets is shown opposite page 30, reproduced from one of two old paintings belonging to David Dehane Napier; the other shows the steamer *Superb*, built in 1820.



"UNITED KINGDOM," SECTION.

From Herbert's "Encyclopaedia," 1835.



"UNITED KINGDOM," ENGINES.

From Herbert's "Encyclobaedia," 1835.

to his station at the bows and resumed his employment. At last, however, he was favoured with a storm to his contentment, and when the seas breaking over the vessel swept her from stem to stern, he found his way back to the captain and repeated his enquiry, do you call it rough now? On being told that the captain did not remember to have faced a worse night in the whole of his experience the young man appeared quite delighted, and muttering as he turned away, 'I think I can manage if that be all,' went down contentedly to his cabin, leaving the captain not a little puzzled at the strange freak of his passenger. Napier saw the end of his difficulties, and soon satisfied himself as to the means of overcoming them.

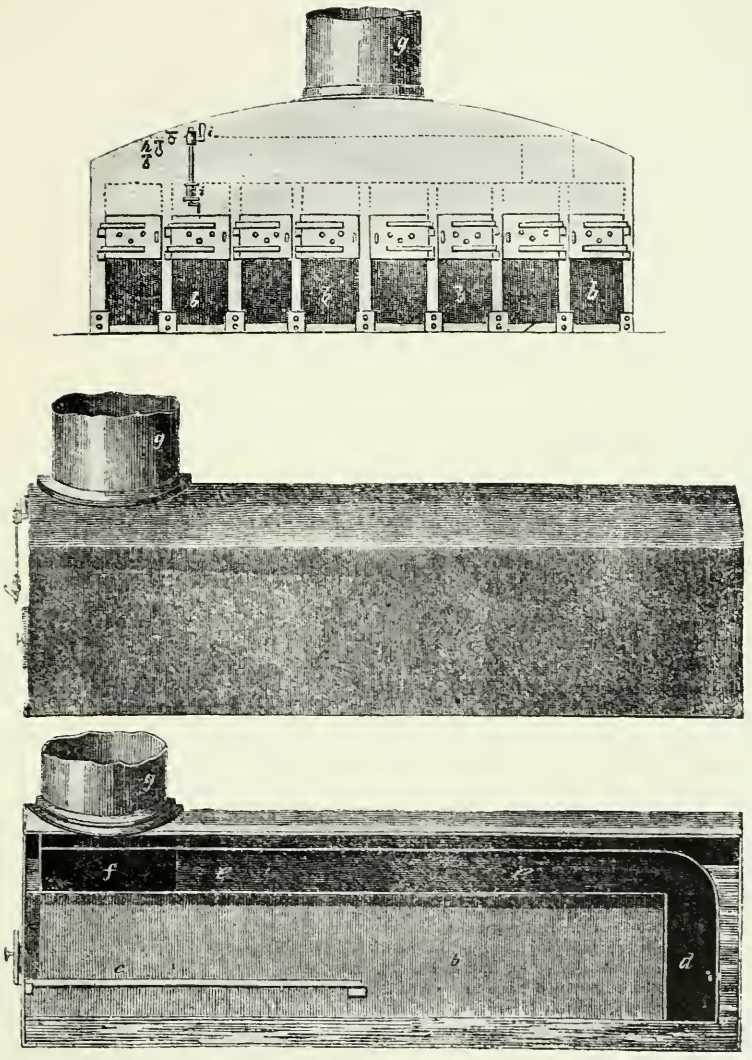
"His next enquiry regarded the means of getting through the water with least resistance. To determine this, he commenced a series of experiments with models of vessels on a small tank of water, and found in a short time that the full round bluff bow adopted for sailing vessels was quite unsuitable to speed with mechanical propulsion of a different nature. He was soon led to adopt the sharp fine wedge-like entrance by which the vessels built under his superintendence were so much distinguished.

"In 1818 Mr. David Napier established between Greenock and Belfast a regular steam communication, by means of the *Rob Roy*, a vessel built by Mr. William Denny of Dumbarton, having about 90 tons burden, and thirty horse-power. She plied two winters between these ports with perfect regularity and success, and was afterwards transferred to the English Channel to serve as a packet between Dover and Calais.

"Having thus acquired dominion of the open sea, Mr. Napier was not slow to extend it. In 1819 the Messrs. Wood built for him the *Talbot* of 150 tons, with two of Mr. Napier's engines, each thirty horse-power; this vessel was by far the most perfect vessel of her day, in all respects,

and formed a model which was long in being surpassed. The *Talbot* plied between Holyhead and Dublin, and was the means of conferring on Ireland the advantage of a direct, certain, and rapid communication with England. The *Talbot* was succeeded by the *Ivanhoe*, built by Mr. Scott of Greenock, of 170 tons burden, with Mr. Napier's engines of sixty horse-power in the aggregate, and she also long continued the best packet on the station between Holyhead and Dublin.

"At the same time that Mr. Napier was thus engaged in conferring on the public the benefits of the Post Office steam packet system, he also established the first line of commercial steamships on a station, which, ever since that time, has continued to be occupied by the finest, most powerful, expert and fastest steam packets in Europe—the station between Liverpool, Greenock and Glasgow. The *Robert Bruce* of 150 tons, built by Messrs. Wood, with Mr. Napier's engines of sixty horse-power; the *Superb* of 240 tons, by Mr. Scott, with Mr. Napier's engines of seventy horse-power; the *Eclipse*, by Mr. Steele, of 140 tons burden, with Mr. Napier's engines of sixty horse-power, all these were established as regular deep-sea traders, under the direction of Mr. Napier, before the year 1822. They were all vessels of a much stronger hull, a better form, and more correct proportion of parts than any others; and in these three years from 1818, the art of steam navigation had received in the Clyde an extension and perfection that rendered it an object of great national importance. The *United Kingdom* was properly speaking a frigate, being a ship of 160 feet long, 26½ feet beam, and 200 horse-power. It was built by Mr. Steele of Greenock, and the engines were constructed by Mr. David Napier. This vessel was by far the most splendid of her day, and gave rise to the large class of merchant ships of which the advantages are now



"UNITED KINGDOM," BOILERS.

From Herbert's "Encyclopaedia," 1835.

reckoned so great, and which are now in common use. Mr. Napier was also one of the first persons to introduce surface condensation in marine engines. He used it successfully in the *Post Boy*, a steam vessel built by him in 1822. The condenser was made of a series of small copper tubes, through which the steam passed towards the air-pump, and by a constant current of cold water encircling the pipes, the steam was cooled and returned into water, which was again sent into the boiler for conversion into steam, without being mixed with the cold salt water, which in the usual plan is injected into the condenser. The next change introduced very extensively into steam vessels by Mr. Napier, was the use of an upright or vertical steam-engine, or engine of direct connection. He made several modifications of the vertical engine, which appear to include all the best that have yet been introduced, although many appear to claim the invention. It does not appear ever to have been established that the engine of direct connection is practicably preferable to the lever engine, but the plans of Mr. David Napier appear to have been the best ever adopted."

V

Life in London: 1837-1869

Mr. Napier continued in business at Lancefield Foundry till 1836, and then decided, as the Memoir states, to withdraw from public business. In doing so he did not contemplate inactivity, but only a change in the character of his work. He now meant to have greater leisure for the maturing of improvements that had been occupying his attention, and opportunity for the building of iron vessels by his sons, fitted with machinery embodying his inventions, so that experiments could be carried out with these in practical service. The proposed steamboats which this scheme implied could, obviously, have been constructed quite conveniently on the Clyde; but the question of finding a service where they might be employed profitably was, in this case, a consideration of the first importance. He already had a number of passenger steamers on the Clyde, and the excessive competition that had arisen there made it undesirable to increase their number. In this respect the Thames would doubtless appear to offer a much more favourable field. The building of iron steamships had only been recently commenced on the Thames; passenger traffic there was capable of great extension; and the prospect, further, of his sons being able to establish a business for themselves, with his assistance, in such an important centre would prove attractive. The family as a whole favoured the proposed change, and, after due consideration, it was definitely resolved upon. Napier could not but recognise the sacrifice involved in leaving his well-known works, established in a

MILLWALL HOUSE.

FRONT IN 1904.

locality so favourably situated in respect of coal, iron and labour; but the feeling of enterprise and hopefulness carried the day, and the removal was carried out.

By the close of 1837, land had been acquired for the new establishment, the site as it came into Napier's hands being bare river-side ground, part of the "waste marsh-land which formed the Isle of Dogs." It was of considerable extent, and what was reckoned "a high price" was paid for it. Much additional expense, however, was incurred, and a great amount of difficult work was found necessary to fit the ground for the purpose in view. In the following year building-slips were formed, workshops built, and the requisite machinery erected in place. The upper part of the ground was reserved for a dwelling-house, garden, and offices, in much the same way as had been done at Lancefield. Fairbairn's shipyard[1] immediately adjoined Napier's, and both yards, as afterwards referred to, were used together for the building of the *Great Eastern*. The new premises came to be known as the "Napier Yard," and the dwelling-house as "Napier House." It is curious to find that after a lapse of seventy-five years, these names remain in current use,—"Napier Yard" being the present address of Messrs. Joseph Westwood & Co., Ltd., and their offices still designated "Napier House." (Illustrations showing front and back views of this house, reproduced from photographs kindly taken by Mr. Hy. Rigby, manager of Messrs. Joseph Westwood & Co., in 1904, are shown at pages 36 and 38.) While the works were being completed, Napier designed the first of his experimental steamboats, and her construction was commenced in 1839 by his sons, John and Francis, whose work is more fully referred to later. The combination of iron shipbuilding with the more familiar work of

[1] Messrs. William Fairbairn & Co.'s yard at Millwall had been started two years before Napier went there; and during the fourteen years or thereby of their operations a large number of vessels were built. Iron vessels were first built on the Thames in 1832, and it has been said that the first iron steamboat built there was the *Daylight*, by Ditchburn & Mare, in 1838. As, however, Messrs. Fairbairn had commenced three years before that, it cannot be doubted that they had produced iron steamers before the *Daylight*.

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marine engineering had a peculiar interest, at this time, alike for Napier and the juniors. He found himself here in most congenial surroundings.

Writing to a gentleman in Scotland shortly after the works had been started, he explained that he would have liked to spend some time with his friend, but from week to week found himself unable to leave. "My sons," he wrote, "are as busy as nailers, and paying more in wages than I ever paid in my most bustling days. They think they would do as well if I were absenting myself oftener, but I cannot think of quitting such a busy scene."

His interest in everything pertaining to steamboats and the furtherance of steam navigation was as keen as ever, and his time was now given mainly to his improvements, patents and experiments. He was, as in former years, frequently consulted with regard to the establishment and extension of steamship concerns, and as his steamboat connections and other interests involved much correspondence, with occasional visits to Scotland and elsewhere, his life continued to be one of much activity.

Not long after his settlement in London an incident occurred which appears to have given him considerable anxiety. One of the vessels he had engined years previously experienced the not uncommon misfortune of a boiler flue collapsing, through insufficiency of water, and the explosion which resulted was attended with fatal results. No responsibility rested upon Napier, but as maker of the boiler, he was called upon to attend the judicial enquiry that followed. It was shown that he had previously recommended a condensing apparatus to prevent formation of the deposit, which was a known source of danger to the boiler, but this had not been complied with, and, of course, he had no control otherwise. It became apparent that some of the London engineers were disposed to impute the accident not to its real cause, but to the design of the boiler, and he felt obliged to protest strongly, pointing out that a boiler made by one of these same engineers had, but a short time before, met with a similar disaster,

MILLWALL HOUSE.

BACK IN 1904.

and that nothing in the design of his boiler could be held as accounting for the present accident. It happened about the same time that the *British Queen*, engined by Robert Napier at Glasgow, arrived in the Thames, and a letter written by David has the following observation: "I went down the river with the *British Queen*, they unfortunately let one of the boilers get dry while coming round, either carelessly or willingly, which has given the Cockneys another handle against Scotch engineers. I have no doubt that she will make a good passage both out and home, which will close their mouths." The complete success of this vessel, it may be said, amply fulfilled Napier's prediction.

To a correspondent who requested him to undertake the introduction of a newly-patented engine he expressed regret at being unable to do so, but referred the patentee to his cousin Robert, to whom he thought the scheme might be useful, adding that, if wished, he would have pleasure in recommending it. To another correspondent in America, who asked a quotation for engines similar to those the writer had seen in Liverpool (the *Richmond's* probably), he explained that he removed to London for the purpose of putting his sons into business, and they would be glad to supply the engines wanted at fifty pounds per horse-power, delivered on board complete. "They are," he added, "making alterations, rendering them still more compact. If you are not particularly partial to double engines, single engines could be made for five pounds per horse-power less. We made a steamer, at present plying on the Thames, with a single engine of upwards of 100 horse-power, called the *Eclipse*. She is the fastest in this country, and we are at present making another, still more powerful, with a single engine." The *Eclipse* was said to have a speed of about sixteen miles an hour, and the report that she was the fastest steamer in Britain appears to have gained a wide currency. It attracted the notice of Mr. Thomas Assheton Smith, of Wales, an enthusiast in the building of steam yachts, whose paddle yacht *Fire King*, built to his own model, was said to have a speed of fifteen miles per hour.

Speeds, it may be recalled however, were not at that time ascertained by reliable measured-mile trials as now. Mr. Smith, a sporting man, had issued a challenge in *Bell's Life* that his *Fire King* would run against any steamer then afloat from Dover pier round Eddystone Lighthouse and back, for five thousand guineas. He appears further to have addressed this challenge to David Napier personally, whose brief reply was as follows:

"Millwall. May 11, 1842.

Assheton Smith, Esq.,

Sir,—On looking at the chart, from Dover round Eddystone Lighthouse and back to Dover is a longer run than the *Eclipse* is calculated for. I have no objection to accepting the challenge from Dover round the Isle of Wight and back to Dover, neither vessel to use sails.—I am, etc.,

D. Napier."

It is not known whether the contest was carried out, but if it took place the result may be somewhere chronicled. Smith for many years after this continued to have a succession of steam yachts, paddle and screw, built by his friend Robert Napier, both owner and builder doing their utmost to secure the best speed results.

In this same year David was invited by what appears to have been a Parliamentary Committee to state his views on certain naval questions then under discussion. One of the topics submitted was the relative merits of "full bows" and "sharp bows." His replies, given apparently *viva voce*, have not been found, but as he had solved this question conclusively more than twenty years before, there can be no doubt as to the opinion he would express. He pointed out that owners were still in the habit of "putting their full-bowed vessels into dock to get them made sharper," and with the best results. Another subject put forward was the utility of "floating breakwaters," which Napier thought might be tried, but no particulars have been found as to the local conditions which these structures were intended to meet, or their proposed form, method of mooring, etc.

JOHN D. NAPIER.

MILLWALL PERIOD.

From photo belonging to David Dehane Napier.

When consulted, as he frequently was, by inventors with respect to proposed patents or new mechanical devices, he gave to such enquiries, as his letters show, the most courteous and careful consideration, his replies in some cases being most cordial and encouraging, while in others he indicated frankly defects or features in the scheme that would preclude the successful claiming of a patent. While thus "aye ready" to give assistance freely to practical persons, it is evident on the other hand that he could express his impatience emphatically when his professional advice had been sought and given but was persistently neglected or set aside. To the secretary of a steamship company, for example, whose directors requested his continued attendance at their weekly meetings, he intimated that, as the matters he "ought to have knowledge of and had fully reported on were still being disregarded," he must decline further attendance, he found it impossible he added to go on meeting with "a dozen people three-fourths of whom did not know anything of the subject they were talking about."

His interests were not, however, confined to engineering matters of a strictly professional kind, and among the schemes that shared his attention at this time was a plan which he submitted voluntarily to the municipal authorities of Glasgow for the disposal of that city's sewage. This was a problem that had long been discussed, but was still found difficult of solution. A report by Messrs. Bateman and Bazalgette, who were employed to deal with the subject, mentions that Napier proposed to intercept the sewage at the outfalls, where it passed into the Clyde, by the use of suitable hopper-barges, which would convey the sludge far out into the Firth, and discharge it into deep water, remote from residential places. He offered, it is said, a sum of five hundred pounds to give this plan a trial; but although a similar system has been carried out elsewhere on a large scale, and with much success, it would undoubtedly have proved wholly inadequate to meet the rapidily growing needs of Glasgow and the Clyde area.

Mr. Napier's sons, John[1] and Francis,[2] under the style of "J. & F. Napier," and with their father's assistance, commenced business as engineers and shipbuilders at Millwall in 1839, their younger brother Robert assisting. They began with the construction of Mr. Napier's first experimental iron steamboat, *Eclipse*, 156 feet long, 19 feet beam and 80 tons measurement. Being built in accordance with the patent of April, 1839, she had a double bottom, divided longitudinally by girders 16 inches apart, the spaces between them forming channels through which the exhaust steam was made to pass to be condensed. Above the inner bottom, a water space, one and a half inches deep, was formed by another light but water-tight plating, and a continuous flow of sea water passed through this space from stem to stern. The steam condensed by the cold surfaces above and below was collected and returned to the boiler. This construction, it was claimed, added at the same time greatly to the vessel's strength. The engine had a single cylinder, and four boilers were used, in order to experiment with flues of different kinds. The first wheels were of ordinary form, but replaced for experiment by others of the form patented in 1841. After trials it was considered that the latter gave an increased speed. The speed was about sixteen miles an hour, which an independent writer states "was about two miles an hour faster than any steamer at that time on this side of the Atlantic," a performance which "gave a great impetus to marine engineering."

The *Eclipse* was, in 1840, placed on the route between Blackwall and Margate, her runs being subsequently extended to Herne Bay and Dover. Her passenger capacity, four to five hundred, was frequently tested in the conveyance of troops under an agreement with the War Office. The young men were naturally proud of their first vessel's success, and their father, after fully a year's experience, wrote that his sons "had been successful beyond expectation, the steamer's speed being so far beyond that of others

[1] [2] Reproductions of photos of John and Francis taken about this time will be found opposite pages 40 and 42.

FRANCIS NAPIER.

MILLWALL PERIOD.

From photo belonging to David Dehane Napier.

that opposition is out of the question." After two seasons' running it was remarked, "we have not yet met with a competitor to the *Eclipse*," and she evidently attracted considerable attention both at home and abroad, various offers having been made to purchase or charter her. In Barham's *Smuggler's Leap* her name occurs in the lines:

> "If in one of the trips of the steamboat *Eclipse*
> You should go down to Margate to look at the ships,
> Or take what the bathing-room people call 'dips.'"

In 1841 two more vessels were put in hand; first, the *Rocket*, a small experimental steamer of which the dimensions have not been ascertained. She had one 36-inch cylinder, a tubular boiler working at about twenty pounds pressure, but her speed was less than that of the *Eclipse*. After being tried with different wheels she was placed on the Margate route. The second steamer of this period was the *Isle of Thanet*, completed in 1842, and placed on the Margate and Ramsgate station. No particulars have been found of her dimensions or machinery, but she "surpassed all the other steamers several miles an hour, exceeding even the *Eclipse*."

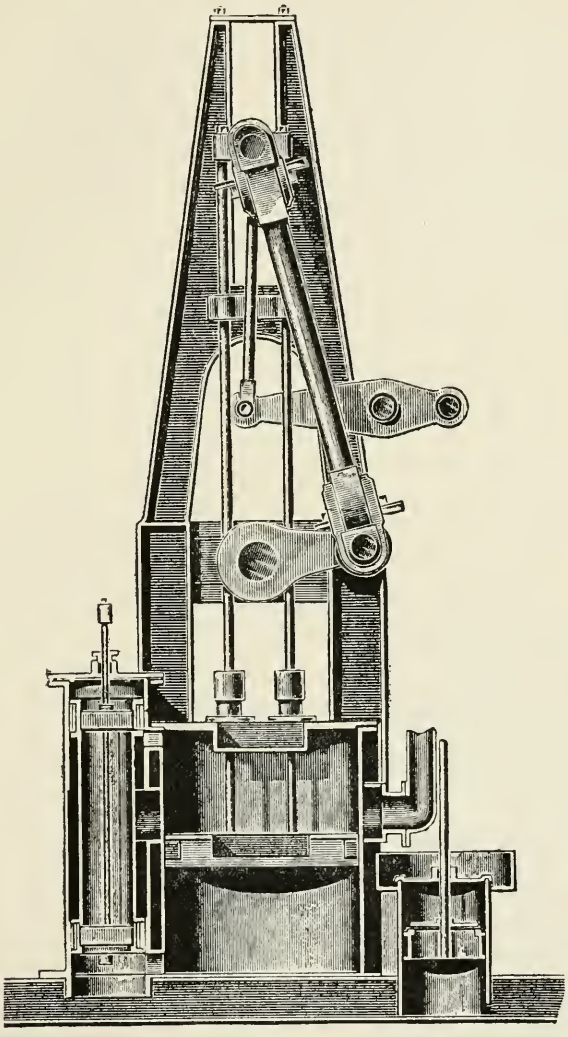
From a historical sketch of "The Thames Steamboat Companies," published by *The Engineer*, Sept., 1900, and Nov., 1897, the following interesting particulars are obtained of another steamer, built at the Millwall works probably about 1843:

> "Of the twelve boats owned by the Waterman Steam Packet Company, eleven were engined by the Messrs. Penn (although the name of the last fitted by them was *Waterman No. 12*). These had oscillating engines, embracing their makers' latest improvements.
>
> "Of the one steamboat of the dozen (*Waterman No. 9*) not engined by Penn there is something worth noting. Possibly it may not be known that the mystic art of 'betting' is not altogether a product of these enlightened days. It

flourished half a century ago, and heavy bets were made on the performances of some of our river steamboats, so high had the spirit of rivalry attained among the captains, if not the owners, of these boats. The order for *Waterman No. 9* boat was therefore given to her builder, Mr. David Napier of Millwall, under rather onerous conditions. She was to be constructed of iron, and fitted with engines, under a guarantee that she should, when completed and tried, beat every other vessel of her class on the river, while burning less fuel, and this she did thoroughly. The dimensions of this vessel were: Length between perpendiculars, 107 feet; breadth at paddle boxes, 15 feet; depth under deck, 7 feet 2 inches; draught of water, 2 feet 9 inches. She was propelled by a single engine—known as a 'steeple-engine'—having a cylinder 30 inches diameter, with a piston stroke of 3 feet. Its piston was fitted with four piston-rods, whose upper ends were attached to a four-armed crosshead, from the centre of which the connecting-rod hung, the lower end of the latter embracing the crank-pin brasses, with a strap secured to it with a gib and cotter. The air, feed and bilge pumps were worked by a rocking beam, one end of which was connected by links to the piston-rods crosshead. The engine was of the surface-condensing type. The vessel being double-bottomed, the space between the two bottoms was used as a condenser, into which the steam, after use in the cylinder, was admitted, its condensation being effected by external cold, the resultant fresh water being used for boiler feed. This engine, invented by Mr. Napier, offered many advantages by its compactness and direct action for river-boat service. Its one objection was the protrusion of a large portion of the machinery above the deck, which rendered it unsuitable for sea-going vessels.

"The boiler supplying this engine with steam was of the vertical cylindrical type, 7 feet diameter, with a circular

fire-grate, over which was a 14-inch water-space, in whose upper or tube-plate was a series of concentric circles of tube holes,



STEEPLE ENGINE OF "WATERMAN No. 9."

From "The Engineer" of 28th Sept., 1900.

fitted with water-tubes. Their lower ends communicated with the bottom water-space, and the upper ends with the water

above the top tube-plate, the hot air and gases in their passage from the fire-box permeating among the tubes,—which were of brass,—and thus imparting their heat before reaching the chimney. The steam-producing power of this boiler was very great, and its consumption of fuel exceedingly moderate."

As competing steamboats were plying to the same ports as Napier's, although none were equal in speed, a keen rivalry appears to have existed between the masters of the respective vessels. This at times led to incidents on both sides manifesting more zeal than discretion, and a total disregard of passengers' wishes and convenience. A curious episode of this nature involved no less a personage than Charles Dickens, and his indignant letter on the subject to Messrs. Napier may be quoted, as illustrating these amenities of old-time travel:

"1 Devonshire Terrace, York Gate,
Regent's Park,
Monday, Second October, 1843.

Sir,

I beg to inform you that this morning, at Margate, a travelling bag belonging to me, a drab bag fastened with a padlock and two leather straps, containing among other things some articles of plate, was carried by my servant on board of the *Isle of Thanet* Steam Packet by mistake. The Captain refused to allow it out of the vessel, and to prevent its being taken away had it removed from the heap of luggage.

I went on board myself and explained to him that no one belonging to me had been on board for an instant except my servant, and requested to have it delivered up.

I did so in the presence of another gentleman who was with me. He still refused to comply with my request, and did so with great insolence and violence of manner.

Being unable to recover the bag I was obliged to leave it in the possession of this person, who had, I need scarcely say, as much right

to it as if he had stopped it on the highway. I cannot think that the Company by whom this Officer is employed would willingly expose any gentleman to conduct so unwarranted and perfectly unjustifiable. I therefore make the circumstances known to you, and request your immediate attention to it. At the same time I hold myself bound to say that if I do not receive my property tonight, at my own house, I shall make a personal application on the subject tomorrow morning in the City Justice Room, for the twofold purpose of recovering what belongs to me, and of making the public acquainted with the circumstances of a proceeding in which they are quite as much interested as I am, now that the opposition on these Stations proceeds to such outrageous lengths.

I am, Sir,

Your obedient Servant,

Charles Dickens."

To the Clerk, or Agent,

Isle of Thanet Steam Packet Office.

Charity may credit the captain with a virtuous sense of duty in preventing the removal of articles left in his vessel for which he might be held responsible, but with greater probability it may be assumed that he had simply determined to secure the owner of the bag if possible as a passenger, rather than let passenger and bag go to the vessel of the opposition company. Needless to say the "bag" was duly restored to its owner, with Messrs. Napier's apologies for their officer's misapplied zeal. Up till this time the mercantile and working arrangements of the steamboats had been managed by the younger Napiers, but, from the increase of traffic, and the claims of their own proper work, they felt now obliged to relinquish the steamboat business, although to their father's regret. The Millwall establishment was carried on for about ten or eleven years after this, a considerable amount of new and repair work

passing through the firm's hands, reference to which however does not fall within the scope of the present narrative. Another iron experimental steamer, the *Severn*, appears to have been built there to Mr. Napier's instructions, fitted with his rotary engine, which proved to be quite successful. This vessel plied for some time at Worcester under his personal supervision, and another was projected but not built, which he intended should be a screw steamer.

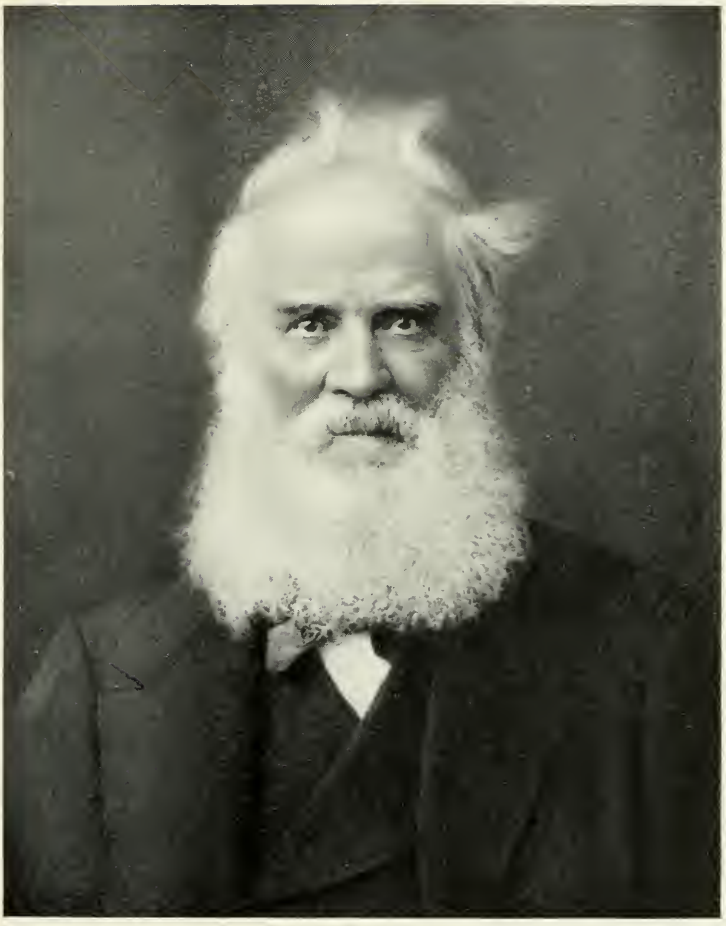
It had ultimately become apparent, from the experience of so many years, that the natural disadvantages of the Thames gave little prospect of a permanently successful engineering business. Mr. Napier had himself to admit that "London never would be a place for building steamers, on account of everything connected with their production being higher there than in the north." This conclusion having been arrived at, it was, of mutual consent, agreed to bring the business to a close, and allow the premises to be leased or disposed of. The works therefore stood idle for fully a year, until, in 1853, a further use was found for them. As the Napier Yard adjoined that where Mr. J. Scott Russell was then commencing the construction of the *Great Eastern*, and the space and resources of both places being found necessary for that undertaking, an arrangement was made to combine them temporarily. Part of the Napier property was accordingly leased, in 1853 or 1854, and a small portion, that had been otherwise occupied, was arranged for at a later date. The following extracts are of interest:

"37 Great George Street,
Westminster, 25th July, 1857.

David Napier, Esq.

My Dear Sir,

I am sorry I had not the pleasure of going over the big ship with you, to have profited by your observations. How do you like the lines? is she sharp enough for you? You say you would make



DAVID NAPIER.

From photo belonging to David Dehane Napier.

the next ship longer,—if this one is long enough to go round the world it might be worth considering whether we should not wait till the world grows bigger before making a longer ship.

JOHN SCOTT RUSSELL."

"WORCESTER, 28th July, 1857.

MY DEAR SIR,

Although I could have had more for the land than what you propose, it has been such a favourite hobby of mine for the last twenty years,—magnitude for the ocean,—and being fully convinced that this one will not have made half a dozen voyages till a larger one will be wanted,—with a view of giving every facility for such being done I accept of your offer.

DAVID NAPIER.

JOHN SCOTT RUSSELL, ESQ.

P.S.—I am still amusing myself with the rotary engine, and am now thoroughly convinced that they must, sooner or later, supersede all others. The one I made at Millwall six years ago is going better this year than it did at first, and all the principal parts are as perfect as the day they were made. I am going on with another with which I expect to astonish my friends on the Thames and the Clyde."

Napier's prophecy of coming vessels larger than the *Great Eastern* was not to be realised so soon as he anticipated; her unfortunate career checked the enthusiasm of shipowners and naval architects, but his expectation has been more than fulfilled in the gigantic steam liners of recent years. His further conviction that the rotary type of engine would supersede all others seems also likely to be justified ere long, through the splendid results and increasing use of the marine turbine.

Mr. Napier's later years were spent in London in comparative retirement, his interest in the progress of engineering and steam

navigation remaining unabated to the end. He could look back upon an experience wholly unique,—covering the eventful period between the *Comet* and the *Great Eastern*, with both of which he had been brought into personal contact. The contrast between these vessels furnished an appropriate and striking illustration of the amazing advance that had taken place in the interval, an advance due to the skill, experience and enterprise of many workers; and of these workers he had not only been one of the earliest, but may justly be regarded as one of the most active, devoted and successful.

Till within a few years of his death Mr. Napier's vigorous constitution stood him in good stead, but a serious illness then left him permanently weakened, and he died at 8 Upper Phillimore Gardens, Kensington, on 23rd November, 1869, in his eightieth year. The tombstone in Kensal Green Cemetery bears the following inscription:

"In Memory of
MARION,
wife of David Napier, Esq.,
of Glenshellish, Argyleshire,
Died 1st February 1867, aged 73 years.

Also of
ALEXINA,
youngest daughter of the above,
Died 25th January 1868, aged 29 years.

DAVID NAPIER,
Died November 23rd, 1869.
Aged 79."

VI

Steam Vessels, Built for or Engined by David Napier

No list is known to exist of the vessels built for, or engined by, Napier,—and the following particulars, collected from various publications, indicate probably but a small part of his work. Where dates have been ascertained the vessels are placed in chronological order, thereby showing the developments in size and power that took place in the earlier period of steam navigation. The hulls built for Napier up to 1836 were of wood. The Loch Eck steamer, *Aglaia*, he himself built of iron. The greater number came from the yard of John Wood & Co., others were constructed by Archibald M'Lachlan, Dumbarton, and John Scott & Sons, Greenock, all of whom had much previous experience in the building of sailing vessels. Napier's engines were for some time of the side-lever type, with flue boilers; but within a few years he had introduced the "steeple" and other arrangements, with tubular boilers of the haystack form.

Marion, 1815 (see frontispiece, and sailing bill opposite page 4); built by Archibald M'Lachlan, of the Woodyard, Dumbarton; dimensions variously stated as 60 feet by 13 feet, and 70 feet by 14 feet; 57 tons; draft 2 feet 9 inches; 20 horse-power; the first vessel built for Napier, and named after his wife. Plied for a season on the Clyde, and was then placed on Loch Lomond, being the first steamer there (see Note 16); broken up about 1828. Chapman's *Picture of*

Glasgow, 1818, mentions that till November 1817, navigation above the bridges of Glasgow had been reckoned impracticable, but that the *Marion* then steamed as far as the Clyde Ironworks, against a very strong current. A document still extant narrates that her master, Daniel M'Phail, had for a time been master of the *Comet*, and in that capacity was the first to take a steamer to Rothesay. Afterwards, with the *Marion*, he was first to navigate a steam vessel above Glasgow Bridge; and had the "honour also of being the first in taking a steam-boat into the far-famed and romantic Loch Lomond."

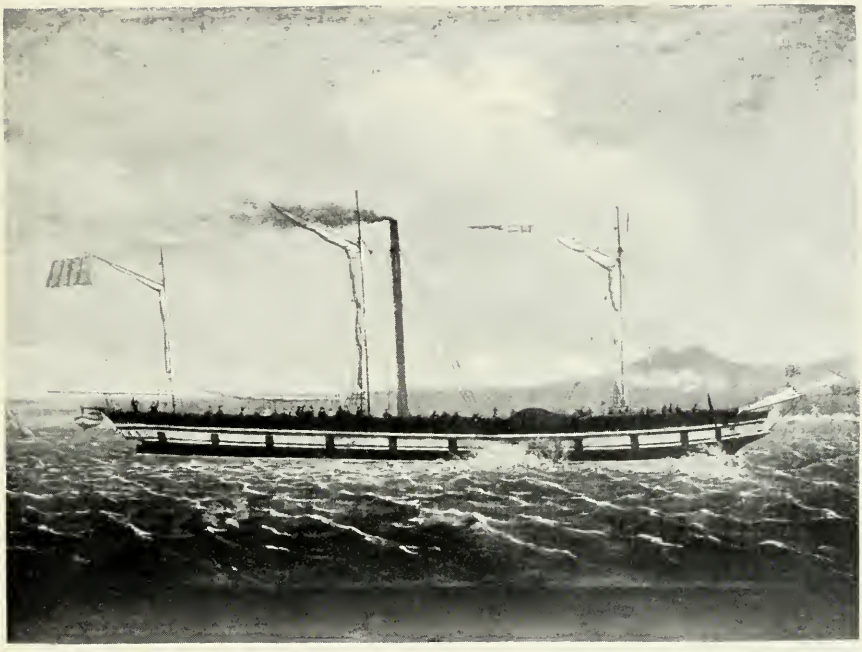
Active and *Despatch*, 1817; built by Archibald M'Lachlan; dimensions variously stated as 60 feet by 17 feet, 80 tons, and 65 feet by 18 feet, 83 tons; 10 horse-power. These were cargo boats that plied on the Clyde; both were in service up till 1834.

Rob Roy, 1818; built by William Denny, Senr.;[1] variously stated as 75 feet by 15 feet 8 inches, 87 tons, and 80 feet by 16 feet, 90 tons; single s.l. engine, 32 horse-power, funnel elliptical. The first steamer to ply between Glasgow and Belfast, on which route she carried the mails and passengers for two years "with great punctuality and without requiring repairs." She was then placed on the Dover-Calais route, and, being purchased by the French Government—the first steamer owned in France—was named *Henri Quatre*. The *Rob Roy* was not only the first steam vessel to navigate the open sea regularly, but was the fastest on the Clyde at the time.

Woodford, 1818; built at Dumbarton; 76 feet by 16 feet, 6 horse-power; this vessel went to Trinidad in 1822.

Robert Bruce, 1819; built by John Scott & Sons; 90 feet by 18 feet, 155 tons; engines, two cylinders, 60 horse-power. The first steamer to ply between Glasgow and Liverpool, "followed year by year by steamships of increasing beauty and power, a class of vessels

[1] William Denny, Senr., was for a time manager to Archibald M'Lachlan, at the Woodyard, Dumbarton, and ultimately succeeded to the business there. The precise date when the business was transferred is not known.



"SUPERB."

From original in possession of David Dehane Napier.

altogether unrivalled" (*Watt Memorials*). "The passage between Greenock and Liverpool was accomplished in twenty-eight hours, an expedition that surpassed the London Mail." She was burnt near Anglesea in 1821, from neglect in letting water out of the boiler. The Parliamentary Report of 1822 contains the following, from T. S. Traill, Esq. :

> "I was exposed to a violent storm in the *Robert Bruce*, and was surprised at the ease with which she wrought in a very heavy sea, and the much less motion she had than a sailing vessel would have had in similar circumstances. Contrary to my expectation her decks were not inundated, we could walk tolerably on them, and even books in open shelves were not displaced, circumstances which also astonished Captain Scoresby junior who accompanied me. In the worst of the gale we made nearly half a mile per hour against a heavy head-sea and a violent gale at west, in approaching the Isle of Man from Liverpool."

Robert Burns, 1819; built by John Wood & Co.; 76 feet by 14 feet 6 inches, 73 tons, 24 horse-power; plied between Glasgow and Helensburgh. Name altered to *Robert Bruce* in 1826, after the *Robert Bruce* of 1819 had been burnt.

Talbot, 1819; built by John Wood & Co.; 92 feet by 18 feet, 156 tons; engines, two cylinders, 60 horse-power. Said to have been the first steamer fitted with feathering floats. The first steamer to ply between Holyhead and Dublin, and described as "the most perfect steam vessel of the period,—an enormous advance in ocean steam navigation." Average length of sixteen voyages from Holyhead to Howth was nine hours twenty-four minutes, and from Howth to Holyhead eight hours and two minutes.

Fingal, 1819; built by William Simons & Co., Greenock; 100 horse-power, 202 tons; for Belfast trade; name altered to *Rosneath Castle* in 1825.

Erin; built by William Simons & Co., Greenock; 100 horse-power, 207 tons; Dublin trade.

Scotia; built by R. Steele & Sons; 100 horse-power, 165 tons; Dublin trade.

These three vessels appear in lists of 1828 and 1832; dates uncertain of *Erin* and *Scotia*.

Superb, 1820 (see illustration, p. 52; reproduced from an old painting); built by John Scott & Sons; 120 feet by 20 feet, 246 tons; engines, two cylinders, 72 horse-power. This was the largest steamer of 1820; built as consort to the *Robert Bruce* on the Liverpool trade, and described as the "finest, largest and most powerful steam vessel in Britain." Said to have had "the first copper boiler ever put into a steamer." She was sold in 1824 for service between Naples and Palermo.

Ivanhoe, 1820; built by John Scott & Sons; 98 feet by 19 feet, 170 tons; engines, two cylinders, 60 horse-power; plied as consort to the *Talbot* on the Holyhead-Dublin route; the average passage about seven hours and a half. These were reckoned "large, complete and efficient vessels; their unexpected success overcame the professional prejudice of the Commanders of the sailing Mail Packets." (See illustration, p. 30.) The *Ivanhoe* was in 1822 taken over by the Post Office authorities, who were obliged to purchase all the sailing packets to clear the station for the introduction of steam vessels. The object was at first to make the steam ancillary to the sailing packets, but it was found the former could do better than the sailing vessels, and two of the latter were kept as ancillary to the steam vessels. (See extract from Parliamentary Report, 1822, Chapter VIII.)

Belfast, 1820; built by Ritchie & Co., Belfast; 190 tons; engines, two cylinders, 70 horse-power; plied between Liverpool and Dublin and Glasgow to Belfast.

Post Boy, 1820; built at Dumbarton, 74 feet by 13 feet, 54 tons; engine 24 horse-power. Had a "clipper bow and figure head, high square stern, and tall black funnel." Experiments with surface

condensation were carried out in this vessel. (See note on Patents). She plied for some years between Glasgow and Dumbarton, leaving Glasgow at 6 a.m ; Loch Lomond passengers were conveyed by coach to Balloch, and the *Marion* left Balloch at 10 a.m. On returning, the *Post Boy* left Dumbarton at 6 p.m. In 1828 her name was changed to *Euphrosyne*, and she plied on Loch Lomond from that date till 1837 or 1838. Thereafter she was sold to a Paisley company and plied between Glasgow and Greenock, and also on her original Dumbarton station, under the name *Dumbreck*.

Rapid, 1820 ; built by Cornwallis, Greenock ; 140 tons ; engines, two cylinders, 56 horse-power ; plied between Glasgow and Belfast, and afterwards from London to Rotterdam. Sold to London in 1824.

Caledonia, 1821 ; built by John Wood & Co. ; 85 feet by 14 feet 6 inches, 84 tons, 35 horse-power ; plied between Glasgow and Helensburgh.

Eclipse, 1821 ; built by Robert Steele, Greenock ; 104 feet by 16 feet 9 inches, 140 tons ; engines, two cylinders, 60 horse-power ; plied between Glasgow and Belfast.

Majestic, 1821 ; (see illustration, page 56, reproduced from an old painting belonging to Mr. Wilson, 83 Jamaica Street, Glasgow, and sailing bill, page 12, reproduced from an original in possession of Messrs. Little & Johnston, London) ; built by John Scott & Sons ; 135 feet by 22 feet 8 inches, 350 tons ; engines, two cylinders, 100 horse-power ; boiler of copper. Plied between Glasgow and Liverpool, making the voyage repeatedly in twenty-two hours.

Mountaineer, 1821 ; built by Cornwallis, Greenock ; 190 tons ; engines, two cylinders, 70 horse-power ; plied between Leith and London, and later between Liverpool and Dublin.

City of Glasgow, 1822 ; (see sailing bill, p. 12) built by John Scott & Sons ; 110 feet by 22 feet 4 inches, 300 tons ; engines, two cylinders, 100 horse-power ; plied between Glasgow and Liverpool, reckoned the finest steamer built at this time, and was arranged like the *Majestic*, these being the most important vessels in the Liverpool

trade. In 1825 she went on the rocks while entering Douglas Harbour, but was floated and repaired, and then sold to the City of Glasgow Steam Packet Company and fitted for carrying goods as well as passengers. In 1836, after receiving new boilers, she was put on the Hull to London trade.

Maid of Islay, 1822; built by John Wood & Co.; 82 feet by 18 feet, 140 tons, 50 horse-power. First engines by Claud Girdwood, replaced by others 60 horse-power by David Napier. She was sailing to the West Highlands till 1839.

St. Winnifred, 1823; built at Dumbarton; 94 feet by 16 feet, 50 horse-power; went to Liverpool.

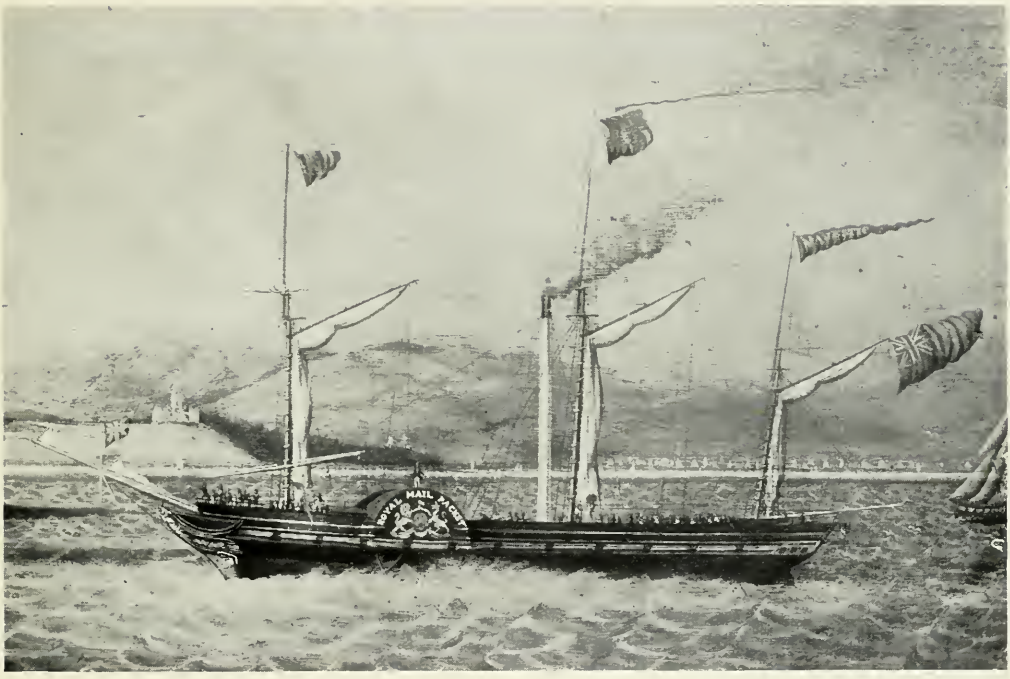
Superb, 1823; built by James Lang; 94 feet by 15 feet 6 inches, 111 tons, 50 horse-power; plied between Glasgow and Rothesay.

George Canning, 1824; built by James Lang; 100 feet by 16 feet, 81 tons, 35 horse-power; plied between Glasgow and Belfast, afterwards between Glasgow and Rothesay; on that route up till 1832.

James Ewing, 1825; built by James Lang; 101 feet by 16 feet 1 inch, 80 tons, 36 horse-power; a sister ship to the *George Canning*; plied between Glasgow and Lochgilphead, and occasionally to Inveraray; was on the Rothesay route up till 1834.

Chieftain; date, etc., not recorded. Sold by David Napier to the Commercial Steam Packet Company, London.

United Kingdom, 1826; built by Robert Steele; 175 feet by 26 feet 6 inches, 561 tons; s.l. engines, 200 horse-power; "a specimen of very superior workmanship." (See sketches, pages 32 and 34.) Built to ply between Leith and London; sailed from Greenock to Leith round the north of Scotland in July, 1826. She was considered a "prodigious step in advance in size and power, speed, and the whole style of her furnishings and appointments." Boiler was of iron plate, 25 feet 6 inches long, with rectangular tubes, having a fire at one end. Gauge-cocks and tubes fitted; and an arrangement for surface condensation. Cost about £40,000. She was reckoned the fastest packet then built, the voyage between Leith and London



"MAJESTIC."

From original in possession of Mr. Wilson, 83 Jamaica Street, Glasgow.

being usually performed in from forty to fifty hours. About 1831 she got a thorough overhaul and a new boiler of copper.

Aglaia, 1827; 30 tons; built by David Napier, and referred to in Memoir as the small steamer put on Loch Eck. This was the first steam vessel built of iron on the Clyde, and the first to ply on Loch Eck; Captain Taylor master. When being taken to the loch, the engine and boiler were conveyed by road, and, with assistance of the residenters, the boat was pulled up the River Echaig. Napier placed another steamer, the *Cupid*, on Loch Fyne, so that passengers could be taken right through from Glasgow to Inveraray; this being the "new route" referred to in the Memoir. After many years' service the *Aglaia* was replaced by an improved steamboat. At Glenshellish, the property Napier had near Loch Eck, are still to be seen some old paddle rings (see page 60), taken no doubt from one or other of these boats, and used for many years at the farm as "stack-stools."

Venus, 1827; built by John Wood & Co.; 111 feet by 16 feet, 86 tons, 70 horse-power; plied between Glasgow and Kilmun.

Cupid, 1828; built by John Wood & Co.; 58 feet 3 inches by 11 feet, 30 tons, 10 horse-power; plied on the Clyde and on Loch Fyne.

Vale of Cluid, 1828; built by John Wood & Co.; 98 feet by 16 feet 6 inches, 50 horse-power; went to Liverpool.

Corsair, 1828; built by John Wood & Co.; 120 feet by 20 feet, 100 horse-power; went to Belfast.

Belfast, 1829; built by John Wood & Co.; 108 feet by 19 feet, 123 tons, 60 horse-power; plied twice a week between Glasgow and Belfast.

Clyde; built by M'Millan & Duncan, Greenock; 310 tons; engines, two cylinders, 160 horse-power; plied between Glasgow and Liverpool.

Lady of the Lake; built by William Denny; 90 tons, 25 horse-power; plied between Glasgow and Kilmun.

Loch Eck, 1829; built by John Wood & Co.; 82 feet by 12 feet 4 inches, 38 tons, 30 horse-power; plied between Glasgow and Kilmun.

St. Mun, 1830; built by William Denny; 114 feet by 15 feet, 64 tons, 60 horse-power; plied between Glasgow and Kilmun, also Rothesay and Ayr; sold about 1834—it was understood to an English firm.

Rothesay, 1831; built by James Lang; 96 feet by 16 feet, 70 tons; plied between Glasgow and Rothesay.

Kilmun, 1831; built by John Wood & Co.; 120 feet 6 inches by 16 feet, 103 tons, 20 horse-power; steeple engines; plied between Glasgow and Kilmun. In 1834 was sailing to Rothesay. Sold in 1836.

Earl Grey, 1832; built by Robert Duncan & Co.; 120 feet 3 inches by 16 feet, 105 tons, steeple engines; plied to Rothesay and Inveraray, also on Kilmun route. In July, 1835, while lying at Greenock quay, her boiler exploded, and a number of persons were killed and injured. The boiler had been supplied a few weeks before the occurrence by a Mr. G. Mansell, who was a witness at the trial of the *Earl Grey's* engineer. The steam valve was controlled by a rod passing down to the engine-room, and the engineer was tried for overloading it, but was acquitted. After being repaired the vessel continued to ply on the Clyde.

Loch Lomond, 1838; built probably by Denny; the first iron steamer to ply on Loch Lomond.

Severn, 1851; built it is understood at Millwall, and fitted with Napier's rotary engine; plied on the Severn, and afterwards, it is believed, on the Clyde.

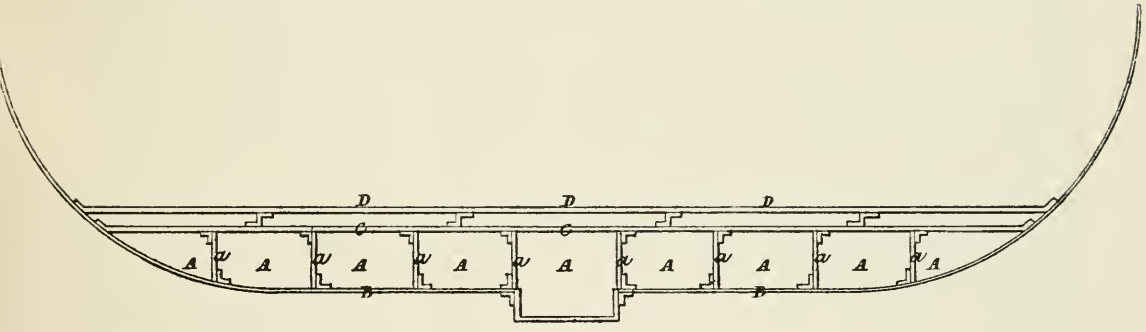
Rotary, 1853; built by Henderson, Renfrew; 146 feet by 14 feet, 66 tons; rotary engine, to Napier's patent, made by Thomas Wingate & Co.; plied to Dumbarton.

(See also experimental vessels built at Millwall, referred to in Chapter V.)

VII

Patents

Mr. Napier's patents included—No. 8044, 1839. *Improvements in Iron Steam-boats*, viz. the constructing of Iron Steamers with two water-tight bottoms, and applying the space between them in condensing the exhaust steam from engines. This arrangement, it was claimed, secured greater strength and safety, a saving of power in working the air-pump, and less wear and tear of boilers. Fresh water



SECTION OF DOUBLE BOTTOM.

From Patent Specification.

being always used, and the quantity remaining nearly always the same, accidents arising from want of water in the boilers could scarcely occur. It was recommended that in "steamers of magnitude" the double bottom be continued up the sides of vessels.

A, space between the bottoms *B* and *C*; *D*, inner water-tight floor, about 1½ inches above *C*, into which sea water flowed through

openings at the bows and out at the stern, thereby keeping the surfaces of *C* always cold; *a*, *a*, iron keelsons rivetted to *B* and *C* for the double purpose of resisting the internal pressure and strengthening the vessel.

No. 8893, 1841. *Improvements in Propelling Vessels.* One part of this invention consisted in placing two wheels or propellers of equal diameter at the stern of the vessel, the axles of both above the level of the water, and one wheel further aft than the other, to permit the blades or float-boards of one wheel working nearly up to the axle of the other. These wheels, on patent drawing, had each eight oblique blades, radiating from a central disc. A further arrangement in this patent applied to side wheels. The floats, in this case, were connected at their lower edges to a heavy metallic frame, the weight of which kept the floats, all round, in a nearly vertical position.

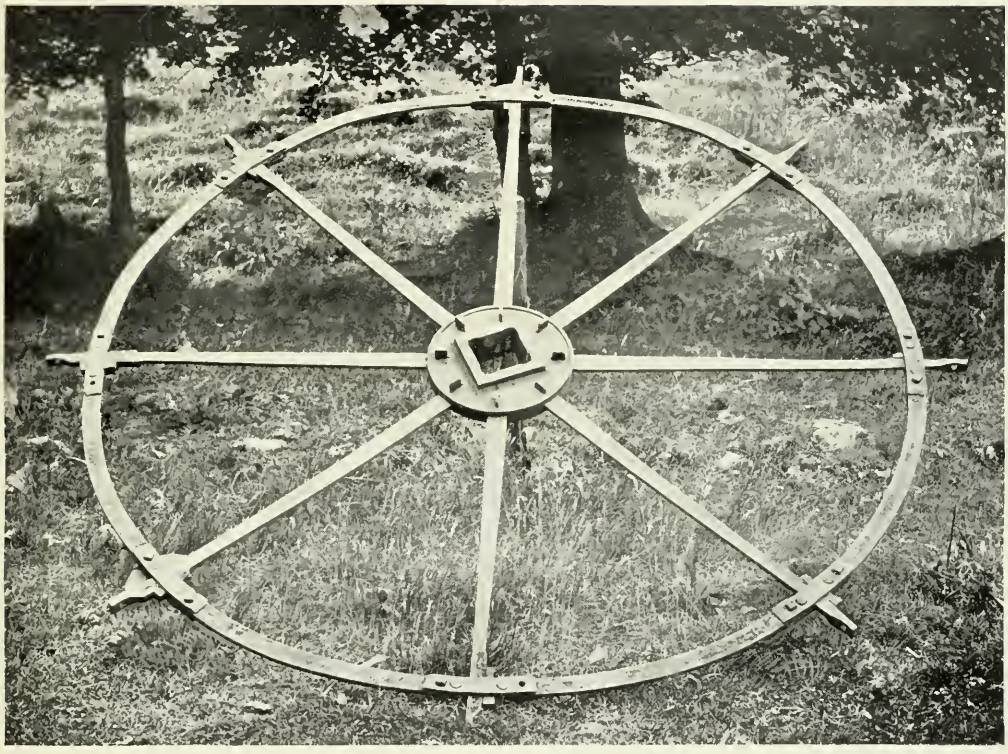
No. 9439, 1842. *Improvements in Steam-Engines and Steam-Engine Boilers.* This patent covered the various forms of the vertical engine with return connecting-rod, known as the "steeple engine," one, two or four piston-rods being employed. It also included the well-known "haystack" boiler.

A feed-heating apparatus was also specified, the feed water being pumped through an annular casing at base of funnel, and thence into the boiler.

No. 11652, 1847. *Improvements in Steam-Engines and Steam Vessels.* This covered several arrangements of marine engines, securing compactness and simplicity, and permitting the cylinder to be placed immediately under the paddle shaft. Also a double bottom under the engines, forming a casing for condenser tubes, with pump to circulate condensing water when the vessel was at rest.

No. 13884, 1851. *Improvements in Steam-Engines*; included a rotary engine, water-tube furnace bars, forced draught, and a valve causing engines to stop, go ahead, or reverse.

No. 1044, 1852. *Improvements in Steam-Engines*; included



OLD PADDLE WHEEL.

AT GLENSHELLISH HOUSE.

heating air for boiler furnaces (an application of the "hot-blast"), suitable also for locomotives.

It may be noted that the longitudinal girder system of construction for vessels' bottoms, as specified above, dates some fourteen years before its adoption by Mr. Scott Russell in the *Great Eastern.*

Surface condensation was applied in the *Post Boy* in 1820, nineteen years prior to the above patent; and the *United Kingdom*, 1826, also had a surface condenser. The copper tubes used are said to have been about 12 feet long and $\frac{5}{8}$ inch diameter. The *Rotary* also was similarly fitted, but with a separate iron casing in the engine room, at side of vessel, to contain the tubes.

A model of Napier's side wheel is shown in the Science Museum, South Kensington. Experiments were made in several of his boats with the side and stern wheels.

The steeple engine was introduced about 1831, and for a long period was, in its various forms, the favourite type of engine for passenger steamers in Britain and America. It is still used in tugs and smaller-sized paddle-boats; and in a number of passenger steamboats engines of this description are still doing good work, after forty to sixty years' constant service.

In a modern high-class Clyde steamer the original horizontal boilers were some time ago replaced by others of the "haystack" type, thereby effecting a considerable saving of weight, lessened draught of water, and a marked increase in speed.

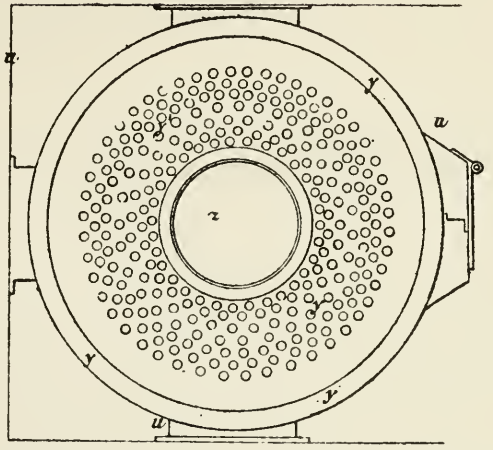
Many varieties of rotary engine had been designed and tried before Napier's time, but none achieved any great success.

Napier's first rotary was, in 1851, fitted into a steamboat built at Millwall; and another was constructed for him, probably in 1853, by Thomas Wingate & Co., Glasgow. The former ran successfully for a considerable time, but the Clyde vessel did not prove so satisfactory. She plied for about two years, but her performances fell short of Napier's expectations, and the engine was replaced by one of ordinary

type. The latter engine had its single cylinder placed on a bed-plate in the engine room, and its power was transmitted to the paddle-shaft overhead by two heavy rubber belts, said to have been each about six inches by one inch. Napier's view of the advantages to be gained by the rotary was given in the *Glasgow Courier* of 26th March, 1853, as follows:

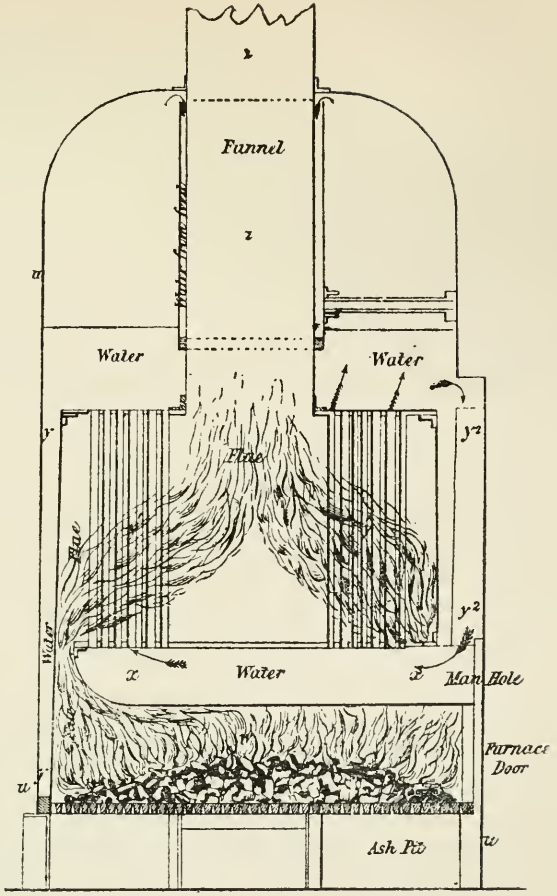
"The advantages these engines have over other engines are, that they are more compact, consume about one fourth less fuel, and require no engineer. The steersman, by a peculiar valve, moves the vessel ahead or astern without communicating with any one. The furnace bars contain water, consequently the hot ashes, which are destructive to the common furnace bar, in this case tend to the production of steam. There is also a simple application of the fan to assist combustion. These two parts of the patent might be applied with advantage to most steamers. These engines are not now a matter of experiment,—a steamer was fitted with them in London above a year ago, and has been plying on the Severn with complete success, the engine being as perfect now as on the day it was made; and from the far-famed workmanship of the Clyde it is expected this one will prove equal, if not superior, to the one made in London. Such steamers would be invaluable on crowded rivers like the Clyde, as running down would scarcely ever happen,—the steersman standing before the funnel, and there being no paddle-boxes to interrupt his view, he sees every object ahead and can stop or reverse the engines in an instant without leaving the wheel or applying to any second party."

Napier retained his confidence in the principle of rotary engines, and, four years later, wrote that he was going on with another of this type, but no particulars of it have been found. Rankine, in 1859, stated that the number of rotary engines that had been patented in Britain alone was upwards of two hundred, but that very few had been brought into practical operation, and these to a limited extent only. "The most successful," he added, "appear to have been the Earl of Dundonald's and Mr. David Napier's."



WATER TUBE BOILER, HORIZONTAL SECTION.

From Patent Specification



WATER TUBE BOILER, VERTICAL SECTION.

From Patent Specification.

It will be seen that there were few of the essential improvements found in the modern steamship, engine or boiler which Napier did not anticipate or foreshadow in his patents. The screw-propeller, although not patented, appears to have suggested itself to him as far back as 1820, as indicated by the following letter:

"MILLWALL, September 17th, 1841.

SIR,

It is upwards of twenty years since I came to London to take out a patent for propelling vessels on the screwing principle. On my arrival I found that a Mr. Shorter in the Borough had made experiments of that kind nearly twenty years before that, of which I had ocular demonstration by Mr. Shorter turning out of his cupboards and presses perfect models of vessels with machinery and springs attached. A few years afterwards I was introduced to Mr. Perkins of steam-gun notoriety, who shewed me a deviation on Mr. Shorter's (for which he had obtained a patent), exactly the same as a Mr. Ericsson tried a few years ago on a boat called the *Robert F. Stockton*, which went to America. Seeing that I could not be considered the Inventor, as I at first thought I was, it cooled my ardour in prosecuting the matter, until, about three years ago when I came to reside here, I found all the world agog about it as a thing that had never been thought of or tried before. Learning that none of the new experimenters had any connection with Mr. Shorter, the original inventor, and that he was in all probability dead, being an old man when I first saw him, I considered the field open for resuming the subject. As I was of the opinion that, although attended with many advantages, there was a considerable waste of power having the wheel or propeller entirely immersed, I have taken out a patent for working two wheels astern, the lower part only immersed, by which I expect to get a greater resisting surface; and the wheels of such a diameter as to enable the engines to be connected directly to the propellers. I have made several trials on a small steamer called *Rocket*; after

CERTIFICATES

FROM

ADMIRAL SIR RICHARD BICKERTON,

AND THE

CAPTAINS OF HIS MAJESTY'S SHIPS DRAGON, SUPERB, &c. &c. &c.

GIBRALTAR BAY, July 4, 1802.

S I R,

the Ship under-way, and went up and down the Harbour to the greatest satisfaction of all Persons who saw the Exhibition.

I believe we shall lay here some Time, therefore, I take this Opportunity, by one of His Majesty's Cutters, which sails direct for *England*, and now under-way, of sending you the opinion of ADMIRAL BICKERTON, and remain

S I R,

Yours Respectfully

JOHN SHOUT.

COPY OF OPINION OF ADMIRAL BICKERTON,

KENT-VALETTE, the 2nd. of Sept. 1802,

S I R,

HAVING been on-board the DONCASTER Transport, and examined the working of the *PROPELLER*, while the Ship was under-way: I have to inform you that I think the Plan a good one, & that it may, in many Instances, be found Useful.—I am,

S I R,

Your obedient Servant,

R. BICKERTON,

To the Master of the DONCASTER.

Printed by WM. NEWMAN, (*Mercury Printing-Office,*) Wildgate-street, Bishopsgate.

CERTIFICATES

FROM

ADMIRAL SIR RICHARD BICKERTON,

AND THE

CAPTAINS OF HIS MAJESTY'S SHIPS DRAGON, SUPERB, &c. &c. &c.

GIBRALTAR BAY, July 4, 1802.

SIR,

I Arrived here on the 1st after a Passage of Ten Days from *England*, and at the Time of my Arrival had a fresh Breeze at S. W. in consequence of which, had not an Opportunity of making Use of the *PROPELLER*, but Yesterday being *Calm*, I [illegible] the DONCASTER under-way by Desire of some Captains in the Navy and several others, when it was exhibited to the great Surprize and Satisfaction of all Present; for at the same Time the *Log* was hove, and found the Ship, although deep loaded, went one *Knot* and a *Half* through the *Water*, entirely by the Use of your new invented PROPELLER.

The inclosed *Certificate* I have received from the Captains of His Majesty's Ships DRAGON, and SUPERB, in order that the Utility of the grand *Machine* may be made known to all Persons concerned in Shipping, especially Ships coming up the *Mediterranean*, where we are so much subject to *Calms*.

I have received Orders to go to *Malta*, and shall sail this Afternoon, if *Wind* permits.

Your's JOHN SHOUT,

Master of the DONCASTER *Transport.*

To Mr. SHORTER,
No. 83, Wapping-Wall.

WE, the under-mentioned Captains of His Majesty's Ships DRAGON and SUPERB, have seen the DONCASTER moved in a *Calm*, the Distance of Two Miles, in GIBRALTAR BAY, and with sufficient Velocity, by the sole Use of Mr. SHORTER's PROPELLER, to give her Steerage-way.

GIBRALTAR BAY, July 4, 1802.

S. AYLMER, Captain of H. M. S. DRAGON,
[illegible] KEATS, D[illegible] SUPERB.

2nd. Letter from Captain Shout.

MALTA, Sept. 4, 1802.

Mr. SHORTER,

SIR,

I Arrived here about a Month ago, from *Gibraltar*, at which Place I wrote to you concerning the *PROPELLER*, likewise inclosed the Opinions of the Captains of the Ships DRAGON, and SUPERB, which I hope you have received before this: on my Arrival here I had a favorable Opportunity in exhibiting the *PROPELLER*, after I got betwixt the *Isle of Gozo* and *Malta*, it fell *Calm*, and continued so Twenty-four Hours, and not likely to have *Wind*, and being only about seven *Leagues*, I Shipped the *PROPELLER*, at 4 A. M. and hove away at the rate of 1 & a ½ Miles *per* Hour, having Eight Hands at the Capstan, one and a half, I arrived in this Harbour at 6 P. M. to the Astonishment of every Spectator: three Days after my Arrival, by Desire of ADMIRAL BICKERTON, I got the Ship under-way, and went up and down the Harbour to the greatest satisfaction of all Persons who saw the Exhibition.

I believe we shall lay here some Time, therefore, I take this Opportunity, by one of His Majesty's Cutters, which sails direct for *England*, and now under-way, of sending you the opinion of ADMIRAL BICKERTON, and remain

SIR,

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COPY OF OPINION OF ADMIRAL BICKERTON,

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SIR,

HAVING been on-board the DONCASTER Transport, and examined the working of the *PROPELLER*, while the Ship was under-way. I have to inform you that I think the Plan a good one, & that it may, in many Instances, be found useful.—I am,

SIR,

Your obedient Servant,

To the Master of the DONCASTER. } R. BICKERTON.

Printed by WM. NEWMAN, (*Secretary to the Post-Office,*) Wildegate-street, Bishopsgate.

many harassing alterations we have attained a pretty fair speed (about 12 miles an hour). With this information, if you think our joint efforts will be of any use I shall be most happy to meet you. I am going to Dover to-morrow,—I expect to be at home Tuesday and Wednesday, when I hope the *Rocket* will be again ready to take the field. She got her propellers damaged by a buoy getting among them; we are reversing the motion, so that she will expel articles floating on the water, instead of grabbing them in.

I am, Sir,

Your obedient Servant,

(Signed) DAVID NAPIER."

The copy letter here quoted does not show to whom the original was addressed.

Edward Shorter, in February 1800, patented a "machine or engine for working and causing the progressive motion of ships and vessels of every description . . . without the assistance of sails or oars."

He proposed (1) an arrangement of endless chains carrying duck-foot blades or paddles; and (2) "angular blades" fitted to the end of a spar or shaft projecting over the vessel's stern, the lower end immersed to a suitable depth in the water, with a floating buoy to prevent it sinking too deep. The upper end of this shaft to have a universal joint connecting it to an inboard shaft, put in motion by wheel and chain driven by a capstan or by a steam-engine if such available. This arrangement, it was claimed, would "have the effect of an endless screw." It was further suggested that the immersed propelling blades could be drawn by guy-ropes to either side to assist in steering the ship.

Opposite page 64 is a reduced facsimile of a document found amongst Mr. Napier's papers, and probably given to him by Mr. Shorter at the interview referred to.

From this it appears that Shorter's propeller was tried in the Government vessel *Doncaster* in 1802, and found to be useful.

VIII

Parliamentary Report on Steam Navigation

In their Fifth Report, dated 12th June, 1822, the Select Committee appointed by Parliament to report upon the Mail Service between England and Ireland stated that they had prosecuted an inquiry "into the important subject of Steamboats." After alluding to the patent of Jonathan Hulls in 1736 for the construction of a steamboat, and to the early experiments of the Duke of Bridgewater, Miller of Dalswinton, Symington and others, the Report proceeds—"Still no practical uses resulted from any of these attempts . . . the whole merit of constructing these boats is due to natives of Great Britain. Mr. Henry Bell of Glasgow gave the first model of them to Mr. Fulton," etc. Bell's efforts to introduce steam navigation with the *Comet* and other steamers, and the successful employment of steamboats in various places, are referred to, "but," it is added, "it was not till the year 1818 that a steamboat was made use of to perform regular voyages at sea. In this year the *Rob Roy*, of ninety tons, built by Mr. Denny of Dumbarton, and with an engine of thirty horse-power made by Mr. Napier of Glasgow, plied regularly between Greenock and Belfast, and *proved the practicability of extending the use of the steam-engine to Sea Navigation.*"

"In the year 1819, the *Talbot*, of one hundred and fifty tons, built by Messrs. Wood, with two thirty horse-power engines made by

Mr. Napier, plied daily between Holyhead and Dublin throughout the whole summer and autumn, and successfully encountered many severe gales. In the year 1820, the *Ivanhoe*, of one hundred and seventy tons, built by Mr. J. Scott, with two thirty horse-power engines made by Mr. Napier, was established on the same station ; and in 1821 the Postmaster General introduced steamboats at Holyhead and Dover for the conveyance of the Mails. During these three last years the *Belfast*, *Robert Bruce*, *Waterloo*, *Eclipse*, *Superb*, *Majestic*, and *Cambria* were constructed, of large tonnage and with engines of great power, for conveying passengers between Greenock and Belfast and Liverpool, between Liverpool and Dublin, and between Liverpool and Bagilt in Flintshire. All these vessels except the *Cambria* and *Belfast* were constructed on the Clyde."

It should be noted here that of the ten vessels named above as having successfully inaugurated sea navigation, nine were the productions of David Napier (the last named, *Cambria*, 1821, was engined by Fawcett & Littledale) ; and in his letter of 25th May 1822, which follows, four other vessels are mentioned as having been built and fitted with his engines "for the open sea." The leading position thus taken by Napier as the promoter of over-sea traffic he continued to hold for many years ; and it is noteworthy, as indicating his progressive views, that throughout this important period his engines were of larger size than those made by other engineers. Some observations of the Committee, in summarising the evidence submitted to them may be added, as bearing upon the work that David Napier had accomplished prior to 1822. Thus the Report states that "The experience of what steamboats have performed is fully sufficient to place beyond all doubt their safety even in the most tempestuous weather. The *Rob Roy* plied two winters between Greenock and Belfast, and last winter between Dover and Calais ; the *Eclipse* plied the whole of last winter between Glasgow and Belfast ; and the *Cambria* been Liverpool and Bagilt, . . . but the trial which the Holyhead steamboats went through during the last tempestuous

winter, from the nature of the service requiring them to go to sea at a fixed hour every day, proves that steamboats, when properly constructed, are able to go to sea when sailing vessels could not." "On referring to the list of steamboats in the Appendix, the *Talbot* and *Ivanhoe* on the Holyhead Station, and the *Belfast*, *Eclipse*, *Superb*, and *Majestic* on the Greenock and Liverpool passage, will be found to be the *first strong and powerful* boats which were built, and they were the *first that completely succeeded.*". . . "The merit of first applying steam-engines to sea navigation is certainly due to the skill and enterprise of the engineers and shipbuilders of the Clyde, for it was unquestionably the *success of their steamboats on the Holyhead Station* which led the Post Office to establish their boats for keeping up the communication between the two countries." This reference to the "engineers and shipbuilders of the Clyde" applied, at this date, only to David Napier, and the shipbuilders he employed in constructing the hulls of his vessels. The special commendation of the Holyhead steamers amply confirms the observations in Napier's *Memoir*. The success of these vessels created much greater confidence in the possibilities of ocean navigation than had hitherto existed, and gave a powerful impetus to its extension. In prosecuting their enquiries, the Select Committee issued a schedule of questions to a number of engineers, shipbuilders and others. As David Napier's replies and letters are of historic interest they are here quoted:

"Glasgow, May 10, 1822.

Sir,

I take the liberty of addressing you relative to a Report which has just now been put into my hands, of a Committee of the House of Commons, dated April 2nd, of which you are Chairman. The evidence therein contained being erroneous does not at all convey to the Committee the information required; and as I am the maker of all the steam-engines, with the exception of the *Tartar's*, denominated in the Report

"Scotch ones," I trust you will readily excuse me for troubling you on the subject. I beg leave to state that I was the first that successfully established steam packets in the open sea from all the ports of England and Ireland they are at present plying from, as from Glasgow to Belfast, Dublin and Holyhead, Greenock and Liverpool, Dover and Calais, London and Leith. It is stated in the evidence that the *Sovereign* and *Meteor* are the only boats that have plied or could ply during the winter. This is not the fact; for the *Eclipse*, which began to run about the same time with the *Sovereign* and *Meteor*, not only plied the whole of the last stormy winter between Glasgow and Belfast, without even once missing her hour of sailing from either side, but has sailed ever since she started without ever missing her hour, or any accident whatever occurring to her machinery, although she was from the month of June to November every day at sea, and four whole nights every week of that period; and the sea in that part of the Irish Channel is fully as rough as anywhere, the tide running very rapidly, which is the cause of one place being more rough than another of equal exposure. She is not singular; the *Rob Roy* has plied these three successive winters—she is at present at Dover—and I understand none of the Post Office packets there can sail with her in bad weather. The *Superb* is now plying the third year between Greenock and Liverpool, and not a single article of her machinery has ever given way, although she has been out in the worst of weather; it would tire your patience enumerating the whole, several others being similarly circumstanced. I can say with certainty that the *Superb* and *Majestic*, presently plying between Greenock and Liverpool, are far superior in every respect to the *Sovereign* and *Meteor*, and will out-sail them in any kind of weather; as a proof of this, the *Sovereign* was at Liverpool the other day and sailed along with the *Superb*, when the latter

out-sailed the former fully one mile in five. I observe Captain Rogers states the *Ivanhoe* and *Talbot* consume nearly double the actual quantity of coals they really do; this I do not think is a wilful mistake, he having too much of the English sailor in him to say anything but the truth, but just gave it as he was told. The *Talbot* is at present here getting some repairs, but before she goes away I will ascertain that point to a nicety; and I would like much the person who gave that information was here to see them weighed and burned. The same cause that burned the *Robert Bruce* would burn the *Sovereign* and *Meteor* or any other steamboat, that is, by keeping fire in the boiler when empty of water; one of the Holyhead boats, I am informed, has been on fire from this very cause. The whole drift of the evidence would appear to be to set forth Mr. Watt's engines, to which I could have had no objection had it been done with due regard to the actual truth respecting the several packets whose engines I have made. The truth is, I have made nearly double the number of engines for boats going to sea that Mr. Watt has, and their machinery has not in a single instance been so far deranged as to prevent them from making their passage in a reasonable time, although some of them are of two and three years standing; and to the best of my knowledge Mr. Watt has not made one but has had the misfortune of breaking down, although none of them is of more than one year's standing. I am sorry that I have been obliged to be so personal, but I do not see how I could avoid it. I have only one request to make, that is, an opportunity of producing a boat in competition with Mr. Watt. If countenanced by Government I will produce a boat that will sail between Howth and Holyhead in opposition to the best boat that is or will be there this season. Government will not be required to pay one penny for her until she has sailed the whole winter through, and not then, unless she has proved

herself the best boat in all respects on the station. I beg it to be distinctly understood that I do not make this request with a view to be employed by Government, but for the mere ends of justice. As a proof of what is herein stated, I will produce the most satisfactory evidence, if required; but for brevity's sake I refer to Henry Monteith, Esq., member for the Lanark district of boroughs.

I am, Sir, your most obedient humble servant,

DAVID NAPIER.

To SIR HENRY PARNELL, BART., M.P."

"GLASGOW, May 25th, 1822.

SIR,

I had the honour to receive your letter dated the 14th inst., and would have replied to it sooner had I not been every day expecting the *Talbot* finished with her repairs, that I could have inserted her exact consumpt of fuel. This I have not yet been able to accomplish, but will in a few days, when I will send it to you; it will be no guide to you regarding the comparative consumpt of fuel betwixt the Scotch engines and Mr. Watt's. I do not believe there are two Scotch boats of the same power that burn the same quantity of fuel, that being a point not paid the least attention to here; fuel being so cheap, not one of them can tell the exact quantity they consume, but merely by guess. There is still a greater difficulty in making that comparison; it is from the contents of the cylinder of the engine that the power is calculated, and I know to a certainty of boats, both on the Thames and Clyde, the cylinders of which vary considerably in size, still the boats are called the same number of horses power, so arbitrary is that mode of christening them; in fact it is a matter of no moment, as any person at all versant with the business can easily make a boiler that will give the utmost effect to a given

quantity of fuel. Before answering the queries you have sent me, I beg leave to notice a little further the Report I took the liberty of finding fault with in my letter to you of 10th instant. All the improvements proposed to be introduced by the evidence of said Report will be found in the *Ivanhoe* (now in the possession of the Post Office) and every other steam vessel I have made to go to sea, viz., the proportion of the vessel, the breadth of paddles, placing the boiler and engine in the bottom of the vessel, and the introducing of the water from the boiler to the sea through the side of the vessel.

Query 1.—With what steam vessels are you acquainted, whether used in rivers or in the open sea?

Answer.—The *Rob Roy*, *Talbot*, *Waterloo*, *Robert Bruce*, *Ivanhoe*, *Superb*, *Belfast*, *Mountaineer*, *Majestic*, *Eclipse*, *City of Glasgow*, and *Rapid*; all of these are used in the open sea.

Query 2.—By whom were they built, and by whom were the engines made?

Answer.—The engines of all of them, with the exception of the *Waterloo*, were made by me; hers by Mr. Cook of this town. The builders are, of the *Rob Roy*, William Denny, Dumbarton; *Talbot*, John Wood & Co., Port-Glasgow; *Waterloo*, *Robert Bruce*, *Ivanhoe*, and *Superb*, John Scott & Sons, Greenock; *Belfast*, Ritchie, Belfast; *Mountaineer*, Cornwallis, Greenock; *Majestic*, John Scott & Sons, Greenock; *Eclipse*, Robert Steele, Greenock; *City of Glasgow*, Scott & Sons; *Rapid*, Cornwallis, Greenock.

Query 3.—What is their respective tonnage, and what the respective power of the engines?

Answer.—The *Rob Roy* is about ninety tons, thirty horse-power; the *Talbot*, one hundred and fifty tons, sixty horse-power; the *Waterloo*, two hundred tons, sixty horse-power; the *Robert Bruce*, one hundred and fifty tons, sixty horse-

power; the *Superb*, two hundred and forty tons, seventy horse-power; the *Belfast*, one hundred and ninety tons, seventy horse-power; the *Mountaineer*, one hundred and ninety tons, seventy horse-power; the *Majestic*, three hundred and fifty tons, one hundred horse-power; the *Eclipse*, one hundred and forty tons, sixty horse-power; the *City of Glasgow*, three hundred tons, one hundred horse-power; the *Rapid*, one hundred and forty tons, sixty horse-power; the *Ivanhoe*, one hundred and seventy tons, sixty horse-power; these measurements are inclusive of engine room,—some of them may not be quite exact, but are all within ten tons of the true measurement.

Query 4.—Have any of these vessels performed winter voyages at sea?

Answer.—The whole of them, except the *City of Glasgow* and *Rapid*, they being this year's production.

Query 5.—Supposing the length of voyage to be twenty leagues from port to port, across a sea exposed to strong tides and heavy gales, how many vessels, in your opinion, would be necessary to be maintained so that two should sail every morning,—that is, one from each port throughout the whole year, except on days when a strong cutter, one hundred tons burthen, would be obliged to put three reefs in her mainsail?

Answer.—I would consider three sufficient.

Query 6.—What description of vessel, as to tonnage, form, strength of building, masts and sails, in your opinion, is the best for sea navigation?

Answer.—For the passage alluded to in the fifth query, I would suppose a vessel from one hundred and fifty to two hundred tons most suitable; of such a form as will give her most speed, and not be injurious to her seaworthiness; of such strength as will resist the shocks of the sea in the heaviest weather without sustaining injury; no more masts and sails

than will be necessary for such a vessel in a gale of wind without machinery.

Query 7.—What description of engine, as to power, materials, and general form and arrangement, and what description of boilers and paddles, in your opinion, are the best?

Answer.—This is rather a difficult question to answer.

Query 8.—In what parts do engines most frequently get out of order, or break?

Answer.—There should no part go out of order or break; if there was a part more liable than another, that liability should be immediately removed.

Query 9.—Can you suggest any improvements in the present plan of building steam vessels, and constructing their engines, boilers and paddles?

Answer.—This is another question of some difficulty to answer.

Query 10.—Can you suggest any plan for enabling a steam vessel to use sails so as to be able to beat to windward, in case her engine should be out of order, at the same time offering but little impediment to her steaming power?

Answer.—This can be easily accomplished.

Query 11.—In a gale of wind with a heavy sea what is the best mode of managing a steam vessel?

Answer.—Steer direct for the port intended, and if she does not make headway try her to beat to windward with sails and machinery combined; failing both of them, a proper constructed vessel will lie-to like a duck.

I have the honour to be, Sir, your most obedient servant,

DAVID NAPIER."

REPORT ON STEAM NAVIGATION

Extract from a Third Letter.

"Glasgow, June 4th, 1822.

Sir,

I have the honour of sending you the enclosed certificate of the *Talbot's* consumption of coals, on a trial made with her on Friday last, which I witnessed. I do not send this as a criterion of what the Scotch boats burn, but for the purpose of correcting the error in the Report I formerly had occasion to allude to. The above trial was made under unfavourable circumstances; the *Talbot* being the first steam vessel on the Holyhead Station, and from want of experience of the people under whose charge she then was the boiler was considerably injured, on which account during the trial on Friday it leaked a good deal, which leakage had to be kept up by a continual supply of colder water, consequently a greater consumption of fuel than if the boiler had been tight.

The *Talbot* leaves Greenock to-morrow for London; when there you will have a more convenient opportunity of sending some person on board to witness the correctness of the within certificate; and with good English coal the consumption will be found to be considerably less.

David Napier."

(*Enclosure.*)

"I this morning took on board the *Talbot*, at Glasgow, three tons twelve cwt. of common Scotch coal, and at 10 h. 49′ a.m. left the former place; at the same moment commenced using the above coal; arrived at Greenock 1 p.m., left Greenock at 1 h. 57′ 30″, and proceeded round the Cumbra Islands; returned to Greenock at 7 h. 15′ 30″, sailing in all a distance of 75 miles; the residue of the 72 cwt. of coal taken on board at Glasgow weighed 15 cwt. 2 qrs. 14 lbs. Including the time we remained burning coal at Greenock before starting from

that place, the exact consumpt was, during the trial, as near as possible 7 cwt. per hour. The *Talbot* has at present the same boilers and engines as she had in 1819 when first started, at which time I commanded her.

ROGER LANGLANDS,

Lieutenant R.N.

GREENOCK, 31st May, 1822."

It will be observed that, in his letter of May 25th, Napier abstained from pronouncing on what he considered the best description of engine, boilers and paddles for the service in question. His unequalled experience at this time in marine engineering led him, doubtless, to have very definite opinions on these points; and equally clear ideas as to possible improvements. Professional interests however, and probably trade rivalries, were involved; and he therefore could scarcely be expected to publish his views in the manner suggested by the Committee's questions. The replies as here given to the eighth and eleventh queries are noteworthy, and very characteristic of the man "aye ready" to deal with difficulties in the most direct way.

MRS. DAVID NAPIER.

From photo in possession of David Dehane Napier.

Notes

1. PETER NICHOLSON

Peter Nicholson, an eminent architect, mathematician, and the author of numerous works on architecture, masonry and other subjects, was resident in Glasgow from 1800 to 1808, and thereafter settled in England. His Glasgow residence was in "Sauchy Hall Road." He was one of the few gentlemen by whom the Philosophical Society of Glasgow was originated in 1802, and he contributed a number of papers to its *Transactions*. In 1803 he was employed by the Corporation of Glasgow to construct a timber bridge for foot passengers over the Clyde, "at the foot of the Saltmarket," which bridge was "justly admired for the simplicity of its construction and light appearance." It is recorded also that "the stately frontage of Carlton Place and the wide embankment of the Clyde were due to this eminent Architect." He was recognised as a superior teacher in mathematical and scientific subjects; and Smiles observes that the celebrated engineer Joseph Clement was a pupil in Glasgow of this "highly ingenious man."

2. CARRON IRON WORKS AND CLYDE IRON WORKS

The famous works of the Carron Company were founded by Mr. Cadell and Dr. John Roebuck in 1759, and incorporated by Royal Charter in 1773. "Carronades," taking their appellation from the works, were first made there in 1779, some of them being used on board British ships that year against the French. The Clyde Iron

Works, three miles east from Glasgow, were started about 1786, and it is recorded that during the years 1798-99, "almost the entire produce of these works was cast into cannon and other artillery equipments." At this time five blast furnaces were kept in constant employment, producing 200 tons of pig-iron per day. It was at these works that Neilson's hot-blast process was first introduced. The mortars, cannon, and carronades were tested by "powder proof," and by hydraulic pressure. The series of wars in which Britain was engaged during the latter part of the eighteenth century and early years of the nineteenth taxed the resources of the War Department severely, and called for the assistance of such iron works and engineering factories as could aid in the production of ordnance and other war material.

A drawing of date 1795 is preserved at the Clyde Iron Works of a 32-pounder cannon of the period. Its length was 3 feet 9 inches, bore about $6\frac{1}{8}$ inches, and weight 17 cwts. If, as appears probable, the cannon on which John Napier was employed were of similar size, the work of boring them out accurately, in view of the imperfect tools then available, suggests a favourable opinion of his machinery, and of the confidence placed in his skill and care. As no railway or steamboat facilities existed, the labour and cost involved in carting such heavy articles from the Clyde Iron Works to Dumbarton must have been great, and doubtless this, and the desire for a wider field, together with the necessity for being nearer the sources of coal and iron, induced Napier to remove to Glasgow.

3. DUMBARTON ENGINE

The description given of this engine indicates that it was of the Newcomen or Atmospheric type, which continued in favour long after Watt's engine had been introduced. Engines of this description were used in steam-vessels till a comparatively recent date. In 1856 Seaward and Capel fitted atmospheric engines to a steamer, having three cylinders of 62 inches diameter; and a Jersey steamer with open-

top oscillating cylinders was running till about 1868. Many atmospheric engines of large size were also in regular use in Lanarkshire and Ayrshire till about 1870, gradually giving place to more efficient motors. One of these employed at a colliery had a cylinder 60 inches diameter and 7 feet stroke. Another of smaller size continued at work at Caprington Colliery till 1901, having then completed ninety-five years' service. It is now preserved in the Dick Institute, Kilmarnock An engine of this type, still at work (1912), belongs to the Farme Coal Company, Limited, Rutherglen, near Glasgow. It was constructed there in 1810 or 1811, and has been in constant service since then, with only occasional short interruptions for overhaul. The cylinder, which was never bored, is $32\frac{1}{4}$ inches diameter and 5 feet 6 inches stroke. It is open at top, and the piston is packed about twice a year with hemp, which, with a little water, keeps it sufficiently tight. Steam of five to six pounds per square inch is admitted by a hand lever, the reverse movement of which allows a jet of water for condensation to be injected through the bottom of cylinder, supplied from a tank placed about ten feet above same and kept filled by a pump on the engine. With twenty-seven to thirty revolutions per minute about thirty horse-power is obtained, the work done consisting in winding up coal from a depth of about forty-three fathoms.

It is not known what became of the Dumbarton engine when John Napier left Dumbarton.

In 1825 over three hundred steam-engines were at work in or near Glasgow, some no doubt of the Newcomen type, but the only one mentioned as of unusual construction was a "rotatory" of sixteen horse-power, in use at Govan Colliery.

4. FRANCIS SMITH

Mr. Napier was married in Glasgow in 1814 to Marion Smith, whose likeness is shown at page 76. His father-in-law, Francis Smith,

had engine works at Camlachie, but appears to have resided at Rutherglen, where, at his death, he left some heritable property.

His burgess ticket reads as follows :

> "At Rutherglen, the fifth day of May, seventeen hundred and seventy-five years.
>
> The which day in presence of Gabriel Gray Esqr present Provost of Rutherglen compeared Mr Francis Smith, Engineer at Camlachie, who was admitted and made Burgess Freeman and Guild Brother of the said Burgh, and received into the haill Priviledges, Libertys, and Immunitys of the same for services done and to be done by him to the said Burgh. And he has given his oath de fideli as use is.
>
> Extracted by
>
> James Marshall, Clk."

One of Mr. Smith's sons, Francis, acted as David Napier's factor when he left Glasgow; and another, David Adam Smith, with his brother-in-law James Rodger as partner, carried on for many years the business of Smith & Rodger, engineers and shipbuilders. Their engine works were at first in Hyde Park Street, afterwards at St. James's Foundry, Broomielaw, immediately west of Tod & M'Gregor's premises. Their Middleton shipyard at Govan was, after Mr. Rodger's death, occupied by Mr. John Dobie; and on his death was acquired by the London and Glasgow Engineering and Iron Shipbuilding Company Limited.

Mrs. Rodger (Janet Smith), the last survivor of Francis Smith's family, died at Glasgow, 31st August 1891, aged eighty-seven years.

5a. HENRY BELL, 1767–1830

The important part taken by Henry Bell in advocating and introducing steam navigation is well known. His intimate friendship and business connection with the Napier's, however, may justify a brief

HENRY BELL.

reference to his career. (A likeness reproduced by Messrs. Annan from an old painting is shown opposite page 80.) According to his own statement, quoted by Morris, Bell was born in 1767,[1] at Torphichen Mill, near Linlithgow. After serving a three years' apprenticeship at millwright work, he was employed for a year at the shipyard of Messrs. Shaw & Hart, Borrowstounness, and thereafter wrought for two and a half years at mechanical engineering. In 1790, when twenty-three years of age, he settled in Glasgow, and in the following year started the business of Bell & Paterson, builders, the partnership lasting for seven years. He was married in 1794, and in 1797 became a member of the Incorporation of Wrights in Glasgow. From about 1786, when he was employed at shipbuilding, he became increasingly convinced that steam-power could be applied to the propelling of vessels. This was prior to Miller and Symington's first steamboat experiment. In 1800 he fitted a small engine and boiler into a pleasure-boat on the Clyde, and in the same year forwarded a statement to the British Admiralty setting forth "the practicability and great utility of applying steam to the propelling of vessels against winds and tides." His suggestions met with no encouragement, but again in 1803 he renewed his appeal to their Lordships, only to be informed that "nothing could be done." His project was likewise opposed by Watt, and receiving thus no support in his own country he prepared "a correct prospectus of his long-matured plan, and forwarded copies to the nations of Europe, and to the United States of America." The *Charlotte Dundas*,

[1] An entry in the Parish Register, preserved in the Register House, Edinburgh, reads: "Apr 7th. Patrick Bell and Margrate Easton, in Torpichen Millen had a son baptised called Hendrey." This entry occurs in the records of the year 1768, but has evidently been interpolated at a date later than the entries that precede and follow it. It is a record of baptism, not of birth, but as Bell's statement is that his "*birth* took place on the 7th day of April, 1767," this date may be accepted as at least approximately correct.

The Register entry of the marriage is:

> "Glasgow, 23rd March 1794. Henry Bell, Wright in Gorbals, and Margaret Young, residenter in Glasgow."

They were married by the Rev. John Mitchell, of Anderston Secession Church.

1802, which he examined, had shown that steam could be applied successfully to smooth-water vessels; but that boat being laid aside, and no financial assistance forthcoming for further experiments, his hopes, like Symington's, remained unfulfilled. The note, 6, on Fulton indicates his indebtedness to Bell. In 1808 Bell became tenant of the Baths Hotel, Helensburgh, and, taking an interest in the affairs of the rising burgh, he was, a few years later, elected its first provost. It was not till 1811 that he was able to arrange for the construction of his first steamboat, the historic *Comet*, and her success encouraged him once more, in 1813, to urge upon the naval authorities the importance of steam-power for the navy. It was about six years after this however before the British Government possessed its first steamboat, and eighteen or twenty years had passed before steam-engines were fitted into a British war-vessel. In 1813 Bell published a pamphlet titled *Observations on the Utility of Applying Steam Engines to Vessels*, etc. From this point his time and attention were given wholly to the extension and management of steamboat traffic, and he had additional boats built from time to time for his passenger service on the Clyde. The unfortunate loss of the *Comets*, first and second, and other disasters, with the keen competition his steamboats had to contend against, seriously crippled his resources, his health failed, and for about five years he was laid aside from active work. He died at Helensburgh, 14th November, 1830, in his sixty-fourth year, and a statue erected by his friend Robert Napier in Row churchyard, marks his resting-place. Monuments at Bowling and Helensburgh, provided by public subscription, further commemorate his public services, and a memorial has recently been placed on the ruins of his birthplace at Torphichen Mill. Letters in the *Glasgow Mechanics Magazine*, 1825, contain an interesting statement of Bell's views at that date regarding the progress and prospects of steam navigation. They refer also to his own work and inventions, including his proposed steam vehicles for roads, and the improved equipment and regulations he considered necessary for the safe working of

steamships. The following document of the same year has an historic interest:

"Glasgow, 2nd April, 1825.

We, the undersigned Engineers in Glasgow, having been employed for some time past in making machinery for steam vessels on the Clyde, do certify that the principle of the machinery and paddles used by Mr. Henry Bell in his steamboat the *Comet* in 1812 has undergone little or no alteration, notwithstanding several attempts by ingenious persons to improve it.

(Signed)	Hugh Baird	Duncan M'Arthur
	Robert Baird	Claud Girdwood & Co.
	John Neilson	Murdoch & Cross
	David Napier	William M'Andrew
	Robert Napier	William Watson."

In Memoriam

HENRY BELL

Died 14*th November*, 1830

(By John Macdonald, Row, Gareloch.)

Beneath this statue Henry Bell is lying,
And o'er his grave the church's shadow falls;
Down on the beach the silvery wave is sighing,
And in the hush of eve the throstle calls.

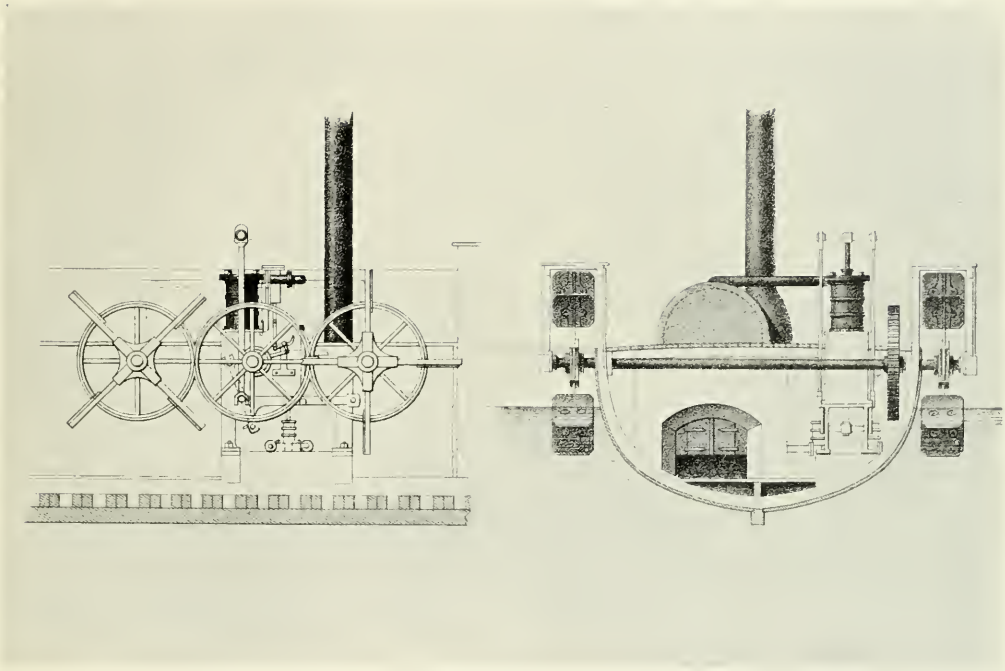
Out in the bay the graceful yachts lie dreaming,
And far across the peaceful Firth I see—
Where Wonder watched the tiny *Comet* steaming—
Great vessels moving in their majesty.

Not he the first to conquer thus the water,
But his the courage and the skill, I deem,
That taught Britannia and her Western daughter
To furrow ocean by the might of steam.

Where rivers run, where wind-blown billow rages,
Pulses the paddle now, the screws propel,
And hist'ry shall record to coming ages
The genius and the fame of Henry Bell.

5B. HENRY BELL. THE *COMET*

The construction of the *Comet* was commenced by John Wood & Co., Port-Glasgow, in October 1811, and John Wood, head of the firm, having died in the end of the year, it fell to his sons John and Charles to carry out the building of this their first steamboat. They described the vessel as "the first steamboat put to use in Great Britain, laid down the same year that the great comet appeared." The original working drawing of the vessel, half-inch scale, presented by John Wood to an intimate friend in Port-Glasgow, and now owned by a son-in-law of that gentleman, gives by scale measurement the following dimensions: Length over all, stem-head to taffrail, 50 feet; on deck, from after side of stern-post to inner side of stem, 42 feet 8 inches; on keel, 40 feet 3 inches. Breadth over planking, about 11 feet 3 inches. Depth moulded amidships, from top of keel to gunwale, 5 feet 8 inches. Centres of paddle-wheels, 6 feet 9 inches apart. A list supplied by John Wood & Co. to the Parliamentary Committee of 1822 states the dimensions as: "Length aloft over stem and post 43 feet 6 inches. Breadth, 11 feet 6 inches. Tonnage register as a ship 25 tons. Horse power 4." Another drawing, on a small scale, presented by John Wood to Robert Napier about 1831, gives the following particulars: "*Comet*, 42 feet by 11 feet by 5 feet 6 inches. Built at Port-Glasgow for Mr. Henry Bell, 1811. J. Wood." She



"COMET'S" ENGINES.

From Woodcroft's "Origin and Progress of Steam Navigation."

was launched on 24th July, 1812, and commenced to run in August. What appears to have been her first trip to Glasgow is thus chronicled in the *Glasgow Herald* of August 10th. "We understand that a beautiful and commodious boat has just been finished, constructed to go by wind-power and steam, for carrying passengers on the Clyde between Glasgow, Port Glasgow, Greenock and Gourock. On Thursday [*i.e.* 6th August] it arrived at the Broomielaw in three hours and a half from Port Glasgow." The *Comet*, after running for some time, was lengthened by Bell, and probably thereby weakened. She was wrecked on the west coast of Scotland, on a voyage from Oban, in October, 1820. Her engine was recovered, and was ultimately acquired by purchase by Robert Napier & Sons, in 1862, for presentation to South Kensington Museum, where it now is.

The sketch opposite page 14, from Woodcroft, shows the appearance of the original vessel with four paddle-wheels, two of which were subsequently removed. The paddle blades or floats were of small size. (See Irving's *Book of Dumbartonshire.*)

The engine was made by John Robertson, Dempster Street, Glasgow. It was not commenced to the order of Bell, nor intended for a boat, being bought for the *Comet* when she was partly built for the sum of £165, and it was fitted on board in the builder's yard at Port-Glasgow. The sketch opposite page 84 shows the arrangement of the machinery. The first cylinder (now in the Art Galleries, Glasgow) is $11\frac{1}{4}$ inches diameter, with a stroke of 16 inches. This was replaced by one $12\frac{1}{2}$ inches diameter and same stroke. With this alteration and the hull lengthened the speed of vessel was about six miles an hour. Of the boiler, which was supplied by David Napier, no particulars exist beyond those contained in the Memoir, but Mr. J. Scott Russell stated (1841) that it was then in his possession. (Facsimiles of the promissory notes granted to Napier for the boiler are shown opposite pages 16 and 18.) A Parliamentary Report of 1817, five years after this vessel's boiler was fitted, states that cast-iron was still being used, in some cases exclusively and in preference to wrought-iron, for

land boilers. It was recorded at a later date that "all the Clyde steamers had low-pressure engines with wrought sheet-iron riveted boilers."

6. ROBERT FULTON, 1765–1815

Fulton was born in Pennsylvania in 1765, came to England in 1787 to complete his training as an artist, and spent five or six years in the study and practice of painting. He then took up the subject of inland navigation, and patented, in 1794, a form of inclined plane as a substitute for canal locks. Two years later he issued a treatise on the improvement of canal navigation, in which, however, only a passing allusion was made to the subject of steam propulsion. He also devised an apparatus for the mechanical excavation of canals, and had an interest in inventions for the cutting of marble, etc., and for the manufacture of ropes. Having acquired a knowledge of the steamboat experiments made in America and in Scotland, he wrote, toward the close of 1794, to Messrs. Boulton & Watt, asking the cost of a steam-engine "designed to be placed in a boat." Whether a quotation was made is not known, but he prosecuted the subject of steam propulsion no further at that time. Believing that his canal system might be specially suitable for France he proceeded to Paris in 1797, and obtained a French patent, similar to that he had taken in England. The disturbed state of both countries, however, owing to the war then in progress, was unfavourable to the introduction of new schemes whatever their merits, and it does not seem that Fulton's canal proposals met with encouragement on either side of the channel. Finding himself detained in Paris much longer than he originally intended, he next turned his artistic abilities to account by painting and exhibiting panoramas; and then, applying his mind to the more practical needs of France, set himself to the designing of torpedoes and submarine boats. About twenty years previously his countryman Bushnell had invented a submarine boat, but both by him and Fulton manual power only was used for propulsion. With funds supplied by

the French government, Fulton was enabled to carry out a series of experiments to demonstrate the utility of his plan, and the "plunging boats" so produced gave some promise of success. The results however were not considered so useful practically as to warrant further expenditure, and the experiments in consequence were allowed to drop. About 1801 Fulton made the acquaintance, in Paris, of his countryman Chancellor Livingstone, who had recently been appointed political agent representing the United States, and who was fully conversant with the steamboat schemes that had been previously tried by Fitch and others in America. He now associated himself with Fulton, and they jointly had a paddle-wheel "tow boat" constructed to be propelled by steam. It was completed in 1803, by which time it is understood Fulton had procured particulars of the Miller-Symington experiments, and of Bell's proposals. Probably he also had seen the *Charlotte Dundas*, which Symington states he visited in 1801. The first steamer tried at Paris proved defective structurally, but it ultimately ran upon the Seine for a short time. Another vessel was built by Livingstone and Fulton, but had no definite success, and as it was apparent that no further assistance could be got in France, Fulton, in May 1804, returned to London. His torpedo experiments had attracted some notice in England, and he was now consulted by the British naval authorities and supplied with means to carry out further submarine tests. These were so far successful, but on the defeat of the allied fleets at Trafalgar no immediate inducement remained for continuing these trials, and they were accordingly abandoned. Fulton's services, however, proved financially profitable, as it is said that he received about fifteen thousand pounds for his experiments; and with adequate funds now in hand he found himself able to arrange for returning to America with a view to the prosecution of steamboat building. In 1804 or 1805 he contracted with Boulton & Watt for the supply of an engine, which they duly forwarded to America; and at the close of 1806 he himself set sail for New York. He then, in conjunction with

Livingstone, had the hull of the famous *Clermont* built on the Hudson, the Watt engine fitted into it, and in 1807 the successful performances of that vessel introduced the era of practical steam navigation in America. Fulton continued to build and manage steamboats till his death, which took place at New York on 24th February, 1815.

7. JOHN WOOD, 1788–1860

The recognised builder of Bell's pioneer steamboat was Mr. John Wood, of Port-Glasgow, whose portrait, reproduced from a photograph in the possession of Mr. James Reid, Port-Glasgow, faces p. 88.

The firm of John Wood & Co. was founded by John Wood, sen., "a man of much talent and ingenuity," at least thirty years before the *Comet* gave a successful start to steam navigation in Britain. He had, in 1811, contracted to build the hull of this vessel, but died before the close of the year, and it fell to his sons John and Charles to complete the contract and carry on the business. John was then only twenty-three years of age, but had acquired a very complete knowledge of shipbuilding from his father, and from having also wrought for about two years in a shipyard at Lancaster. At this early period David Napier was brought into contact with John, and in later years had some of his vessels built by him. During Wood's long business career from 1811 onward he constructed an immense number of vessels of all kinds, a large proportion latterly being steamships for channel and ocean service. Having been the pioneer of steamboat construction on the Clyde, though closely followed by others, Wood maintained his leading position by setting afloat, year by year, a succession of the largest and finest steamships of their time. The firm succeeded early in gaining favourable recognition, the Royal Scottish Society of Arts having, in 1814, awarded them its silver medal; and in later years their work met with further public notice and commendation. Being consulted by the Parliamentary Committee of 1822, appointed to report on the employment of steamships in over-sea postal service,

JOHN WOOD.

From original in possession of James Reid, Esq., Port-Glasgow.

their reply mentioned that till March of that year they had built twenty-two steam vessels (three of which were for David Napier), and had also been employed to alter several steamboats not built by them in order to improve their speed. John Wood attained the highest eminence as a scientific naval architect and practical constructor of steam and sailing vessels. His designs were wrought out, as respects displacement, stability and other essentials, with the greatest thoroughness; in the modelling he exhibited much artistic taste; and he aimed uniformly at the best possible workmanship. He was thus regarded, with reason, as having "set the fashion which other builders followed," and esteemed as "the apostle of a new and better creed in naval architecture than had previously prevailed." In addressing the Institution of Engineers and Shipbuilders in Scotland, 1872, the President, himself a shipbuilder and speaking with a personal knowledge of Wood's professional qualities, referred to him as having been "the father of all that is best in the style of our ships, and truest in the practical application of science in the shipbuilding of Great Britain." Mr. Wood's interests at the same time were not wholly professional, but extended widely into various branches of physical science; and it delighted him to furnish freely whatever knowledge he possessed, whether to competitors in business or any others who might consult him. He was a clever astronomer and most accomplished French scholar. In 1844 he invented a self-registering tide-gauge, for which the Royal Society of Edinburgh presented him with its silver medal, a relic now in possession of his grand-nephew, James Reid. It may be added, as recorded by Mr. J. Scott Russell, that so far back as 1818 Wood experimented in the propulsion of vessels by means of a screw. He fitted to a gig a wooden screw about thirty inches long, with a blade nine or ten inches broad, making an entire revolution round its spindle. This propeller, driven by two men working a crank, gave the boat a speed of three to four miles per hour. The last sailing ship he built was the *Cuyuni*, launched in 1856 for James Ewing & Co., Glasgow.

He was a partner for some time with his relative John Reid, who commenced the building of iron ships in a yard immediately adjoining Wood's, but he took no active part in that business; and during the closing years of his life his leisure was occupied, as a pastime, with the building of small wooden vessels and boats in his own premises. He died at Port-Glasgow on 22nd December, 1860, in his seventy-third year.

8. PATRICK MILLER, 1731–1815

The earliest recorded attempts made in Scotland to propel vessels by mechanical means appear to have been those of Patrick Miller, of Dalswinton, Dumfriesshire. He came of a good family, being youngest son of William Miller of Glenlee, Stewartry of Kirkcudbright, and brother of Sir Thomas Miller, who was created a baronet, and Lord President of the Court of Session in 1788. Patrick was born in Glasgow in 1731, and spent some years of his youth at sea, thereby acquiring the special interest in nautical pursuits which he afterwards exhibited. On leaving the sea he commenced business as banker in Edinburgh, and, having realised a handsome fortune, purchased the estate of Dalswinton in 1785. Prior to that time he had carried out many experiments in the propelling of vessels by paddle-wheels wrought by manual power, and in 1787 he published a pamphlet on the subject which indicated the possibility of steam-power being tried in a subsequent experiment, a suggestion having been made to him by James Taylor that a steam-engine could be applied to drive the wheels. A vessel named *Edinburgh*, built in that year, was the eighth he had experimented with. She was a triple-hull vessel, the narrow hulls connected by the deck and upper-works, with paddle-wheels working in the spaces between them. The wheels were wrought from a hand-power capstan connected by gearing to the axis of the paddles, and the vessel's speed was about four to four and a half miles per hour. In 1786 Miller had met William Symington and examined his model steam carriage, and on hearing Symington's

explanations as to the manner in which his engine could be applied to boat propulsion, he authorised him to have a small engine designed and made that would suit a double-hull boat which was then lying at Dalswinton Loch. This little craft, 25 feet long, was accordingly fitted with a two-cylinder engine, the cylinders 4 inches diameter, and 18 inches stroke, which is now preserved in the South Kensington Museum, London. It was constructed according to Symington's first patent, atmospheric type, working the paddles by ratchet-wheels and chains. The boat was tried in October, 1788, and is said to have had a speed of about five miles per hour. Miller then resolved on having another experiment on a larger scale, with a boat also of double-hull form, but 60 feet in length. He instructed Symington to have the engines for this boat made under his own supervision at the Carron Iron Works. The cylinders were 18 inches diameter and 3 feet stroke ; the power, as before, being transmitted to the wheels by ratchet gear. This vessel was tried on the Forth and Clyde Canal in December, 1789, giving a speed of six and a half to seven miles per hour. Miller now found himself, on the score of cost, unwilling to undertake further experiments, especially as he came to see that the style of engine employed was unsuitable for steamboat propulsion. This fact had been proved by the experience of many previous experimenters, and there was therefore nothing novel or extravagant in his discovery that the atmospheric engine was "the most improper of all steam-engines for giving motion to a vessel"; although it is true that improved engines of that type were so used successfully in later times. (See note 3.)

Miller at this stage unfortunately abandoned the idea of propulsion by steam; but his continued confidence in manual-power apparatus survived, and led him, in 1796, to procure a patent for the same system of mechanism which he had used originally and for so many years. With this retrograde step, unaware apparently of what the double impulse engine could have effected, or wholly distrusting the suitability of steam-power, his efforts in connection with steam

navigation came to a premature close. The *Narrative* drawn up by his son Patrick, in 1825, claims that "it cannot be disputed in point of fact that he (Miller) had fully established the practicability of propelling vessels of any size by means of wheels or revolving paddles, and of adapting to these the almost boundless powers of the steam-engine." This claim must of course be looked at in view of the very limited results actually attained, in view also of the credit due to Symington as the actual engineer, and the claims of inventors of prior or contemporaneous date must also in justice be recognised. On the testimony of Sir Charles G. Stuart, of Monteath, Miller was regarded by his fellow-countrymen as "one of the chief and most distinguished inventors and learned authorities of his day in Scotland, so far as the features and history of her shipping was concerned"; undoubtedly his name will hold a permanent place in the history of steam navigation as a most enterprising pioneer. He died at Dalswinton on 9th December, 1815, aged eighty-four, and was buried in the family burying-ground, Greyfriars churchyard, Edinburgh.

James Taylor, 1753–1825, having been Symington's school companion at Leadhills, and his fellow-student in Edinburgh, was aware of the improvements which the latter had made upon the steam-engine, and of his success in constructing a steam-propelled road carriage. When he entered Mr. Miller's service, as tutor to his sons, in 1785, Miller was engaged in his earlier experiments, and came to know through Taylor of Symington's work in designing an engine and making a road carriage. He then arranged with Symington to construct the small engine referred to in the preceeding note, and fit it into his boat at Dalswinton. It fell to Taylor as Miller's assistant to conduct correspondence with Symington from time to time, and attend to the arrangements connected with the experiments which followed in 1788 and 1789. In 1824,—thirty-six years later, and nine years after Miller's death—Taylor put forward a claim that he, in conjunction with his late employer, had been the real inventor of steam navigation, Symington being represented as simply the operative mechanic who

had carried out their ideas. The facts bearing upon this claim are to be found by a comparison of the statements in the following publications:

1824. *Memorial by James Taylor to Parliamentary Committee.*

1825. *Short Narrative Relative to the Invention, etc.*, by Patrick Miller, junior.

1829. *Brief History of Steam Navigation*, by William Symington.

1833. *Brief Narrative relative to Symington's Work*, by Dr. Robert Bowie.

1842. *Concise History of the Origin of Steam Navigation*, published apparently by or for Mrs. Taylor.

1848. *Sketch of the Origin and Progress of Steam Navigation*, by Bennet Woodcroft.

1857. *Reprint of Taylor's Memorial, with Correspondence*, by Thomas Carswell.

1862. *Biography of William Symington*, by J. and W. H. Rankine.

It cannot be doubted that Woodcroft, an independent and competent authority, stated correctly the conclusion to be drawn from a careful examination of the above-mentioned narratives. He wrote: "it is clear from his own statements and those of his friends that he [Taylor] was neither the inventor of the machinery by which either of these boats was driven, nor of the mode of connecting the engines to the boats and wheels. This, it is admitted by Mr. Taylor and his friends, was done by Symington; neither was Mr. Taylor the first person to suggest the use of the steam-engine to propel boats. His merits then with reference to the origin and progress of steam navigation rest entirely upon his having successfully urged Mr. Miller to try steam-boat experiments, and in having devoted his time and attention in superintending the preparation of his boats for trial."

9. WILLIAM SYMINGTON, 1764–1831

The portrait on page 96 has been produced by Messrs. Annan from a negative taken by Mr. Fergus, Greenock, about 1889, from a sketch by D. O. Hill, R.A., which is now at South Kensington.

The *Brief History of Steam Navigation*, published by Symington in 1829, states that he was born at Leadhills, Lanarkshire, in the year 1764.[1] The following is the substance of his narrative:

"Having commenced the profession of civil engineering, I made several improvements on the steam-engine. In July 1786, I went to Edinburgh, and submitted to the professors of that University, and to other learned and scientific gentlemen, the model of a carriage which I had invented, and intended to be moved on public roads by the power of steam. Upon this occasion I met the late Patrick Miller, Esq., of Dalswinton, who had been informed not only of my model of a steam-carriage but of my previous improvements on the steam-engine, by Mr. James Taylor, a school companion of mine, who was then tutor in Mr. Miller's family. When Mr. Miller called on me at the house of my much-respected friend, the late Gilbert Meason, Esq., he was shown the model of the steam-carriage, and Mr. Miller was pleased to say "It bids fair to improve greatly the commerce of the country by facilitating conveyance and reducing the rates of carriage." Mr. Miller also mentioned that he had spent much time making experiments as to the propelling of vessels upon water, by using wheels in place of sails or oars. These wheels he had hitherto put in motion by applying the strength of men to the turning of a handle or winch. He said he had also attempted to work them by the power of horses, but none of the powers had sufficiently answered his purpose.

"I stated without hesitation that I believed a steam-engine might

[1] The *Dictionary of National Biography* gives "October 1763" as the date of Symington's birth, but as the author of the article has stated that he could not recall his authority for that date, and as the Parish Registers of Leadhills District for 1763-64 contain no entry on the subject, there appears to be no ground for altering the date given by Symington himself.

be constructed to propel Mr. Miller's boats, by communicating a rotatory motion to the paddles by the alternate action of two ratchet-wheels in the same manner as proposed in the model of the steam-carriage then before him, which would render altogether unnecessary the aid of a fly-wheel to regulate and equalize the effects of the steam-engine in turning the revolving oars. The model then before Mr. Miller, and the description given by me of the manner by which I proposed applying the same power to produce a rotatory motion in the paddle wheels, seemed to convince him of the practicability of applying the steam-engine to the propelling of boats, and he said, with a becoming diffidence as to his knowledge of mechanical powers, that if I should think it possible to construct and work a steam-engine with safety on board of a vessel, he would have an experiment made on a small scale as soon as I could attend to it, and he left it entirely to me to devise the plan of the steam-engine, the mode of producing rotatory motion, and the placing of the apparatus with safety in the vessel, only stipulating that my whole energy and ability should be directed to the only end he had in view, that of making the paddle-wheels constantly revolve with a sufficient degree of velocity.

"Upon this mutual understanding I proceeded to erect a small steam-engine upon the principle for which I had previously procured a patent, having two cylinders of four inches diameter, each making an eighteen-inch stroke. This engine having been constructed by my direction and under my eye, I caused it to be fitted on board a double-keeled vessel then lying upon a piece of water near the house of Dalswinton, and this being done, an experiment was made in the autumn of the year 1788, in presence of Mr. Miller and various other respectable persons; and the boat was propelled in a manner that gave such satisfaction that it was immediately determined to commence another experiment upon a more extended scale.

"The second experiment was made on the Forth and Clyde Canal. The machinery was executed at Carron Iron Works under my direction, and was erected in a boat belonging to Mr. Miller which had been

previously built and fitted with paddle-wheels for the purpose of making experiments as to the effect of these wheels turned by the labour of men already described. I fitted into this boat a steam-engine with two cylinders, each eighteen inches in diameter and making a three feet stroke; and in the month of October 1789, I took on board Mr. Miller, the late John Adam, Blairadam; John Balfour, Pilrig; Ambrose Tibbets, Esquires, members of the Carron Company; Mr. James Taylor, my school companion; and David Drysdale, residing at Bankside, near Bainsford, an experienced sailor, to whom I gave the helm, and in presence of hundreds of spectators who lined the banks of the canal the boat glided along, propelled at the rate of five miles an hour, and all parties interested declared themselves satisfied with the success of my performance. . . . These experiments having been successfully completed, I was fully satisfied that the application of paddle-wheels was capable of giving a considerable velocity to the motion of vessels when an impetus was derived from a machine so powerful as the steam-engine; but as Mr. Miller at this period very unaccountably withdrew himself from public business and devoted his talents to the improvement of his estate of Dalswinton, it was left to me to carry into effect the practical results that had hitherto been ascertained, or still further to improve upon them. I at this time was also unfortunately obliged to go to the Wanlockhead Lead Mines to construct machinery upon a large scale, to enable the proprietors to work these mines to advantage, and the attention of all parties connected with the steamboat experiments being for a time directed to other important objects, the boat was dismantled, and its machinery laid up in Carron Works; and thus ended the second trial made by me upon steamboat navigation.

"In the summer of the year 1800, the late Thomas Lord Dundas of Kerse applied to me, and after alluding to the experiments which I had made eleven years before, expressed a wish that I should employ myself in constructing a vessel capable of being propelled by the power of steam through the Forth and Clyde Canal (of which

WM. SYMINGTON.

From negative taken by Fergus, Greenock, about 1889, from sketch by D. O. Hill, R.A.

he was a large proprietor) and of dragging vessels in place of using horses, the power then and still employed in dragging vessels on that canal.

"I, accordingly, under the auspices and patronage of that enlightened nobleman, commenced a series of experiments in January 1801, and continued them till April 1803, which cost upwards of £7000, and which produced the happy results now to be described. A steam-engine was erected with a cylinder of double power, 22 inches in diameter, and making a four feet stroke, and fitted into a boat adapted to the power of the engine; and after making various experiments, in March 1802 (this date given as 1803, but corrected and explained in Dr. Bowie's pamphlet) took on board of the boat, at Lock No. 20 of the canal, the late Lord Dundas my patron, Archibald Spiers, Esq., of Elderslie, and several gentlemen of their acquaintance, and made the steamboat take in drag two loaded vessels, the *Active* and *Euphemia* of Grangemouth, Gow and Esplin masters, each vessel upwards of seventy tons burden, and with great ease they were carried, without the assistance of any horses, through the summit level of this canal to Port Dundas, a distance of nineteen and a half miles, in six hours, although it blew so strong a breeze right ahead during the whole course of the day that no other vessel in the canal attempted to move to windward; and this experiment not only satisfied me but every person who witnessed it of the utility of steam navigation. When it was proposed however to the proprietors of the canal to substitute steamboats in place of drag horses, it was alleged that the undulation created upon the water by the use of the paddle-wheels would have the effect of washing down the banks of the canal, and thereby doing a greater injury to the canal itself than any benefit that could be expected to be derived from the use of such an improvement; and as the proprietors of the canal were entitled to judge of their own affairs, I and the late Lord Dundas, although differing from them in opinion, were bound to submit to their decision; and the result of these experiments was, that I, at the desire of my patron,

caused a beautiful model of the steam-engine and boat to be executed, with a set of ice-breakers attached to it, which was sent to the house of Lord Dundas in Arlington Street, London. I was thus a second time thrown upon my own resources in attempting to achieve the much desired and ultimate object of this invention, viz. the application of steam to the general use of navigation, and was thus with great reluctance obliged to lay up the boat upon which these experiments were tried in a creek of the canal near to Bainsford Drawbridge, where it remained for many years exposed to public view. While lying there, Mr. Henry Bell from Glasgow, who had also witnessed my experiments in 1789, was frequently seen to inspect it, and it was this gentlemen who, in conjunction with others, constructed in the year 1811 the steamboat the *Comet* which first plied on the river Clyde, and the immense advantages resulting from this exemplification of the invention made it to be taken advantage of by the companies who have since so flourishingly prosecuted steam navigation in this country.

"It happened one day during the period that I was employed in conducting the experiments under the patronage of Lord Dundas, viz. in July 1801, that a stranger came to the banks of the canal and requested to see me. He very politely announced himself as Mr. Fulton, a native of North America, and told me that he intended to return to his native country in a few months, but, having heard of the steamboat experiments, he could not think of leaving the country without waiting upon me in the hope of seeing the boat and machinery, and procuring some information as to the principles upon which it was moved. In compliance with his earnest request I caused the engine fire to be lighted up, and the machinery put in motion. Several persons entered the boat, and, along with Mr. Fulton, were carried from Lock No. 16, where the boat then lay, about four miles west along the canal, and returned to the place of starting in one hour and twenty minutes, to the great astonishment of Mr. Fulton and the other gentlemen present. Mr. Fulton asked me if I had any objection

to his taking notes regarding the form, the size, the construction, etc., of the steamboat and steam apparatus; to which I answered that I had none, as I was of opinion the greater publicity that could be given to a discovery intended for general good so much the better. He accordingly took out a memorandum book, and put several pointed questions to me regarding the general construction and effect of the machinery, which were answered with a wish to be explicit, and Mr. Fulton noted down the answers and everything that was described to him, and made his own remarks, while the boat was moving along the canal with him and others on board. I never heard of him again, till I saw an account of his death in an American newspaper, dated Baltimore, 1818. . . .

"Previous to finishing the experiments upon the Forth and Clyde Canal, I went to London, and presented my patron, Lord Dundas, with the model of the steamboat and steam apparatus already described. Upon this occasion his Lordship suggested the propriety of showing the model to His Grace the Duke of Bridgewater, whom he knew to be an ingenious and spirited nobleman, besides being sole proprietor of extensive canals, and who could, if he approved of the invention, adopt it upon his own. His Lordship accordingly called upon the Duke and told him that I was in town, and requested that I might be allowed to wait upon his Grace with the model of the steamboat; to which he replied, 'that it appeared to him altogether needless to amuse themselves further with anything regarding steamboats, as he could well assure his Lordship they would never be made to answer any useful purpose, having himself, subsequent to the experiments which I made in Scotland, bestowed upon the subject much pains and great expense, without affording the least hope of success; yet, with this impression as to the improbability of utility, he was still willing to see anything new upon the subject,' and consented to examine my model.

"I waited upon the Duke next day, and showed and explained the model to him, when he declared that such a vessel as that before him had every appearance of answering the purpose he wished, and pointing

to his collection of paintings, which he said had cost him upwards of £100,000, he stated his belief that the advantage which trade might derive at some future period from the use of such steamboats would many times exceed the value of his excellent gallery of pictures; and to show his conviction of the fact, he gave me an immediate order to build eight such boats for the use of his canal, and pressingly requested me to devote my whole time to the executing of this order with as little delay as possible. I then returned to Scotland elated with the prospect of being able in a short time thus to turn my invention to a useful purpose, and satisfactorily completed my last experiment, then only in progress; but, to my great mortification, upon the very day I had finished it, I heard of the much lamented death of that very worthy and enterprising nobleman the Duke of Bridgewater, together with the determination of the proprietors of the Forth and Clyde Canal not to use the boats, after the pains that had been taken to perfect them. This so affected me that probably I did not use that energy I otherwise might have done to introduce my invention to public notice; and perhaps it was from this circumstance that the introduction of steam navigation was postponed in the United Kingdom of Great Britain till after the Americans had taken advantage of it, and carried the invention into general practice.

"I was advised to apply for His Majesty's Letters Patent to cover my invention, which are dated October, 1801, but, after having put myself to this expense, I discovered that the idea of the application of steam to the propelling of boats is much earlier than my time. So far back as the year 1736, Jonathan Hulls of England procured a patent for the propelling of boats by steam, conform to a plan which he published with a copy of his patent. This boat however was unfit for any useful purpose in consequence of the imperfection of the steam-engine and the awkward manner of applying the power. That ingenious machine was not then brought to such a degree of perfection as to be capable of being used for the production of rotatory motion in a manner sufficient for the propelling of boats, and I humbly

presume to say, but with perfect confidence in the truth of what I say, that *I am the first individual who ever effectually applied the power of the steam-engine to the propelling of vessels*, without saying anything of my original invention of the steam carriage. While advancing this pretension I am confident in being able to maintain it; but, at the same time, I am far from wishing to detract from the merit of any of the ingenious men who have laboured in the same department. Much is due to Jonathan Hulls, and perhaps it is impossible to expect greater progress to have been made in the invention at the time he wrote. Much merit is also due to my first patron, Mr. Miller, to whom the country is much indebted for the improvements he made upon boats and wheels; but it was I alone who invented a steam-engine and actually applied it to the propelling of boats. Although I hesitate not to declare that the improved engine of Messrs. Boulton & Watt has now deservedly superseded every other, it is I who have thus first put upon something like a firm basis the great principle, as it were before but dreamt of, that this mighty agent could be rendered subservient to the purposes of navigation. It would be quite unnecessary for me to make any allusion to the advantages which the public now derives from this invention—they are obvious and great; and every class of society travelling for pleasure or commerce avail themselves of the certainty and despatch it affords."

The *Charlotte Dundas* (see illustration on page 8 reproduced from Woodcroft's *Origin and Progress of Steam Navigation*) in her structural arrangements and practical results may be regarded as having amply justified Symington's claim, just quoted. The first important trial recorded was that of March, 1802, although Symington states that "various experiments" had been made prior to that date. The vessel's performances were entirely satisfactory, but the groundless fear of injury to the canal banks led to her being laid aside in April, 1803. The hull was 56 feet long, 18 feet beam, and 8 feet deep; the paddle-wheel wrought in a cavity astern, about 4 feet wide, on each side of which a rudder was

fitted, connected by an iron rod, and the steering controlled by a hand-wheel forward. It is stated further that "stampers" were attached to the bow of the boat for the purpose of breaking ice on the canal. The engine, constructed by the Carron Iron Works Co. under Symington's supervision in accordance with his patent of October 1801, marked a great advance on any engine previously designed for boat propulsion. The cylinder (22 inches diameter and 4 feet stroke) lay horizontally on a lower platform or deck; the piston-rod being coupled direct to the connecting-rod, which wrought the crank on the shaft of paddle-wheel. By means of "friction-wheels" working within guides the piston-rod had a steady motion, and the air-pump was operated by a bell-crank lever. The engine being placed on the port side of vessel was balanced by the boiler on the other side. This admirable engine was as a whole much superior to many of the paddle engines that followed it in later times; and was the prototype of the horizontal and inclined direct acting engines still used for river steamers. Further details of Symington's work are to be found in the pamphlet by his son-in-law, Dr. Robert Bowie, and in a biography by J. & W. H. Rankine. The latter publication (in which allusion was made by mistake to a *second Charlotte Dundas*) was dedicated to David Napier; and his recollections of the vessel were given in the following letter, written fifty-seven years after he had visited it:

"To the Editor of the *Glasgow Herald.*

Worcester, 1st July, 1860.

Sir,

I was pleased reading a letter in your Thursday's paper about the remains of the first steamboat. Mr. Miller of Dalswinton did make some experiments previous to the *Charlotte Dundas*, but the *Charlotte Dundas* was certainly the first steamboat, ten years before the *Comet* on the Clyde, that was applied to anything like practical purposes in this or any other country.

I have not seen the letter your correspondent refers to about the brick funnel, but I think there must be some misunderstanding on that point, as a brick funnel would topple over when the vessel listed. I think that mistake has arisen from the boiler that was on board the *Charlotte Dundas* having been a common land boiler, built round with brick-work as is usually done on land. Although I believe that both Fulton and Bell saw the *Charlotte Dundas*, I cannot help thinking that it is altogether a stretch of imagination about their taking sketches of the machinery, as that appeared to me quite unnecessary, the machinery being of the simplest kind, superior in construction to many steamers of the present day, so that any person though not an engineer had only to open his eyes when he could see and comprehend the whole at a glance, and retain it in his mind without the aid of pencil or paper. The cylinder lay in a horizontal position on deck, fore and aft the vessel; and the piston was connected to a crank on the paddle-wheel in the stern of the ship; that, with the boiler, constituted the whole machinery of the *Charlotte Dundas*. Although it is fifty-seven years since I saw the *Charlotte Dundas*, and although I did not take a sketch of her machinery, this description will be found correct. Poor Symington, the inventor and constructor of the *Charlotte Dundas*, whom I knew, like many other geniuses who have not the means of carrying out their own inventions, having got disgusted with the world for not appreciating his talents, took to that worst of all remedies for drowning care, and like many other benefactors of their race died poor.

Yours truly,

David Napier."

After the engine had been removed from the *Charlotte Dundas*, dredging buckets, wrought by hand, were fitted in place of the paddle, and applied to clear the canal which she had not been allowed to use in her original condition. Bell, writing in 1827, stated that she was "still used as a dredge-boat."

The hull after being left to decay for many years at Bainsford was, it is believed, finally broken up at Wilson's boatyard at Lock 16 on the Canal, about 1860.

Symington died in the house of his son-in-law, Dr. Bowie, London, on 22nd March 1831 ; and his remains were interred in the Churchyard of St. Botolph, Aldgate Without. A Tablet to his memory was placed in this Church by the Right Hon. Sir Marcus Samuel, Lord Mayor of London, in 1903 ; a bust in marble was unveiled in the Museum of Science and Art, Edinburgh, by Sir William Thomson (Lord Kelvin) in November, 1890 ; and a monument at Leadhills was completed in June, 1891.

10. CAMLACHIE FOUNDRY

As Camlachie (east of Glasgow) was favourably situated for the economical supply of the coal, iron, and labour required for Napier's projected business, and the engineering works of his father-in-law and of Duncan M'Arthur & Co. (the latter engaged in marine work) being there, it may be assumed that these considerations would distinctly influence his choice of this locality for the new factory. The works were erected in 1814-15, and were known as "Camlachie Foundry." The designation of the firm continued for a short time to be "John Napier & Sons, Cast-Iron Founders," but the business was solely in David's hands. His first marine engine, for the steamboat *Marion*, was completed early in 1816. He remained at Camlachie about seven years, but the engineering business increasing he removed to the new and more commodious works which he had erected at Lancefield. Camlachie Foundry was next occupied, and latterly purchased, by Robert Napier (Note 20), and ultimately passed into the management of his brother David as a foundry only.

11. THE *DUMBARTON CASTLE* AND *BRITANNIA*

These Clyde steamers were in course of construction at the time Mr. Napier went to Camlachie, and both were launched in the beginning of 1815. They were similar in dimensions, about 84 feet by 16½ or 17 feet, 109 tons; with double engines of 32 horse-power, supplied by Duncan M'Arthur & Co. The hull of the *Dumbarton Castle* was built by Archibald M'Lachlan, Dumbarton; the *Britannia* by John Hunter, Port-Glasgow. Both were subsequently lengthened and had new engines fitted of greater power.

The *Dumbarton Castle* was the first steamboat to ply from Glasgow to Loch Fyne; for some time she ran between Leith and Grangemouth, but was brought back to the Clyde, and was wrecked in 1829. The *Britannia* was the first on the Glasgow to Campbeltown route; she plied for a number of years on the Clyde, and thereafter went to Londonderry, and, by a singular coincidence, was lost off Donaghadee in the same year as her sister ship.

From the note that follows it will be seen that another *Britannia* was built in 1816 for the Holyhead service.

12. P.S. *BRITANNIA* AND *HIBERNIA*

A contemporary notice of these vessels, corrected as to their length, is to the following effect: The success of steamboats on the Clyde induced some gentlemen in Dublin to order two vessels to ply as packets in the Channel between Dublin and Holyhead, with a view to their carrying the mails. Their dimensions were about 80 feet by 18 feet, being similar in tonnage, scantling and rig to the Government cutters (see illustration, page 30) which then performed that service, but were liable at times to be wind-bound for days together. The hulls were built by James Munn, Greenock; and the engines, of twenty horse-power, were supplied by James Cook, Glasgow. It was further announced that "Mr. Cook, whose eminent abilities as an engineer

have enabled him to make numerous improvements on machinery, has been very successful in constructing the paddles of these packets, so that one man can easily raise them from five to six feet out of water, while the engine is at work, in the event of a heavy gale making that measure necessary. This arrangement is also of great advantage in a sidewind, as the leeward paddle can be taken up and the windward one lowered, so as always to have an equal hold on the water." These boats having been expressly designed for cross-channel service, where strong beam winds had to be reckoned with, an apparatus such as that described would naturally, in the absence of experience, promise to be of much use. The same idea had suggested itself to Fourness and Ashworth of Hull, and was embodied in their patent of 1788, but it is not known whether they actually tested it on their steamboats. The failure of the arrangement in the later boats implies no discredit to its inventor, being only a disappointment such as frequently occurs in connection with pioneer experiments, and it may have been the presence of this wheel-gear that led to Cook's engines proving so unsatisfactory, so that after a brief period of service the vessels had to be withdrawn.

In respect to speed however the *Britannia* and *Hibernia* gave fairly satisfactory results. They left the Clyde in September 1816, and in October the former vessel made the voyage from Howth to Holyhead, a distance of sixty miles, in seven hours; and the return voyage in seven and a quarter hours; these being reckoned admirable performances. Napier's *Talbot* and *Ivanhoe*, for the same service, followed three years later.

13. JAMES COOK

James Cook, referred to by Napier as "the oldest and most respectable engine-maker in Glasgow," commenced business about 1785, as millwright and engineer, in premises near St. Enoch Square, Glasgow. He took up the construction of sugar mills, the earliest of

which were driven by water wheels and windmills, and those of later date by steam power. About 1800 he removed to the south side of the Clyde, where he had acquired a large tract of open ground. The engineering factory he erected there—known as "Cook's Works"—were at the time reckoned very extensive and complete. The sugar industry having then its chief seat in Glasgow Cook's business prospered, bringing him wealth as well as a high reputation. His first marine engine is said to have been fitted into the *Elizabeth*, a small vessel built by John Wood & Co. in 1812 for John Thomson. If so, Cook must be regarded as the first on the Clyde to design and construct machinery expressly for a steamboat, the *Comet's* engine not having been originally intended for that purpose. The *Elizabeth* went to Liverpool in 1814, being probably the first steam vessel to enter that port. Within ten or twelve years thereafter he had supplied the machinery for over twenty steamers; but no record appears to exist of the marine work he carried out in the later years of his business career. Two of the vessels engined by him in 1814 were notable, as having been apparently the first steamers to reach London from an outside port, viz. the *Margery* in the end of 1814, and the *Argyle*, re-named *Thames*, early in 1815; the latter being placed on the station between London and Margate. It is recorded that, in 1815, Cook was visited by two Austrian noblemen then in Glasgow, who examined the machinery of one of his boats with much interest, and that he thereafter furnished to the Austrian government certain plans and models, including those of his latest improvements in "paddle apparatus." In 1822 he supplied the machinery of the *Tartar*, a vessel built by Charles Wood to the order of the Post Office authorities, and intended like the *Britannia* and *Hibernia* for the Holyhead mail service. The engine, from a design by Mr. Broderip, is described as having consisted of a single horizontal cylinder, three feet diameter, with "two pistons connected to one crosshead, and connecting to one paddle shaft." Whatever the supposed merit of this arrangement, it appears to have had no greater success than

Cook's engines in the earlier channel boats; and the *Tartar*, like them, was soon laid aside. It may be here noted, on the authority of Robert Cook, a nephew of James, that until about 1820 nearly all the marine engines made on the Clyde were fitted with conical valves, these being gradually superseded by the slide valve, which, it is said, was invented or introduced by John Robertson. Cook's lengthened experience of marine engineering led to his being consulted by the Parliamentary Committee of 1822 respecting the type of steamships that he considered most suitable for the Irish mail service. He then recommended vessels of about 180 tons—slightly larger than Napier's boats of 1819—to be lightly rigged, with two condensing side-lever engines and two boilers, each having two furnaces. His energy and public spirit were shown in his long connection with the Philosophical Society of Glasgow, of which he was for many years a director; and by the interest he manifested in the work of the Andersonian Institute. In 1831 he presented to that institution, for use in its laboratory, "a new steam boiler with flues after the manner of those used in steamboats." He died about 1835; and the business he had so successfully carried on for half a century then passed into the hands of his former manager—but no relative—David Cook, whose firm was known as D. Cook & Co. David Cook does not appear to have continued the marine engineering. Thereafter James Cook, nephew of James, who had been long in his uncle's employment, together with Robert Harvey, sen., succeeded to the business, the firm then becoming Robert Harvey & Co., sugar-mill engineers. On Mr. Harvey's death, his son Robert came into the management, under whose guidance the business has developed into the present "Harvey Engineering Company, Limited." This firm's speciality is the construction of sugar machinery and erection of central sugar factories, and it has a high reputation in all sugar-producing countries. It thus upholds the traditions of James Cook's original business; and it further possesses interesting relics of his early work, in drawings of sugar-mills made by him, and the original drawings of steamboats fitted with his engines about 1814.

LANCEFIELD HOUSE.

From original in possession of David Dehane Napier.

14. *ROB ROY.* MODEL EXPERIMENTS

These model experiments served Napier's purpose in a practical way, although lacking the precision secured by the more scientific mechanism employed by some shipbuilding firms in recent years. The value of such experiments was not recognised by the early shipbuilders, who, for a considerable period, were content to follow the much more expensive process of altering and re-altering the hulls of existing vessels in order to ascertain what were the proportions and forms most conducive to speed. References to many of the steamboats of that time contain such notes as "rebuilt sharper and deeper"; "a new sharp bow, lengthened five feet, sailing improved"; "bottom twice altered"; "bottom rebuilt and sharpened, sailing improved"; "lengthened six feet forward and eight feet abaft, with a fine entrance and run, went much easier through the water," etc.

It took many years to bring about a fair perception of what a steamship's form should be in relation to her intended speed, but the immense value of model tests, carefully carried out in completely equipped experimental tanks, has been shown by the remarkable "lines," so produced for recent "Atlantic greyhounds" and Dreadnoughts, and the splendid steaming performances of these vessels.

15. CHARLES M'INTOSH, F.R.S. (1766–1843)

This distinguished scientist was the author of numerous inventions and improvements in chemistry, chiefly relating to industrial products. His earlier researches were carried on at his father's "Cudbear" works in Glasgow, and he was for a time associated with the Tennants of St. Rollox Chemical Works. In 1825 he patented a process for converting iron into steel by means of carburetted hydrogen, and he took part with Neilson and others in bringing the hot-blast into practical use. His name, however, is most widely known in connection with his invention for the water-proofing of cloth, the patent

for which was taken in 1822. The business resulting from this invention developed rapidly, and was transferred to Manchester, where it still flourishes. M'Intosh's presage of disaster to Napier's first sea-going steamer would naturally impress itself on the attention of the young engineer, as coming from one so eminent in the scientific world, and so much his senior. It is of interest to find Napier, forty years later, recalling this as an illustration of the distrust with which the idea of steam navigation on the open sea was regarded even six years after the success of the *Comet*. Another example, of still later date, appears in the following extract from Lord Broughton's *Recollections of a Long Life*: "September 12, 1823. Left Lord Grosvenor's and went from Liverpool to Glasgow in the *Majestic* steamboat. Sept 13, within six miles of Greenock the pipes of one of the boilers burst, and our vessel stopped immediately. Had this happened last night we must either have made for Ramsay harbour, or have been lost. I cannot think, after all, that the steam-boats are or can be made secure in a heavy sea off a lee shore. They are very large for their depth. Watt had no idea that his invention could be applied to the sea, and Napier of Glasgow, who made the sea engines, was laughed at, at first. Now three steamboats leave Liverpool for Glasgow every week. The breeze carried us to Greenock just as the *Post Boy* steamboat came up to tow us. We encountered a great many steamboats full of passengers, for the intercourse with Argyleshire and the Western Islands, and almost every place on the West Coast of Scotland, is now carried on by steam. This wonderful invention has changed the face of the country, and the manners and aspects of the people in some respects, and it is yet perhaps only in its infancy. The company on board our *Majestic* were mostly Scotch; intelligent, civil, and well-mannered. . . . No people travel so much and to such purpose as the Scotch."

NOTES

16. LOCH LOMOND STEAMERS

The first steamboat to ply upon Loch Lomond was the *Marion*, of 57 tons. She was the first owned by David Napier, and driven by his first marine engine. Launched in 1816, she ran for a year on the Clyde, and next year commenced to ply on the waters of this famous loch. (A reproduction of her sailing bill, from an original in Kelvingrove Museum, appears opposite page 4.) Napier's connection with this service continued unbroken for the long period of thirty-three years. The *Marion* was succeeded about 1828 by the *Euphrosyne*, originally the *Post Boy*, of similar size. In 1825 an opposition steamer, *Lady of the Lake*, was placed on the loch by a joint-stock company, this boat being 76 feet long and 15 feet broad, with engines of 25 horse-power, supplied by David Napier's cousin Robert. The competition while it lasted was very keen, passengers being carried from Glasgow to the head of Loch Lomond at a nominal fare; but the opposition was soon withdrawn. Three years later this boat was purchased by a new company, who proposed an agreement with Napier for working the steamers jointly; but this he declined. In order the more effectively to maintain the position he had secured through ten or eleven years of pioneer work, he now arranged for the exclusive co-operation of the Dumbarton and Loch Long Steamboat Companies and of the coach proprietors on the route in the carrying out of his passenger service. This resulted in the competing company being obliged to provide special boats and vehicles for their traffic, entailing upon them a serious loss; so that, at the end of the year, their steamer was withdrawn and the company dissolved. The *Euphrosyne* appears to have remained on the loch till 1838, when she was replaced by the *Loch Lomond*, the first iron boat to ply there, and owned jointly by Napier and Mr. John M'Murrich, of Stuckgown, Tarbet. Mr. Napier having gone to London the management of the loch service devolved on M'Murrich for about three years, after which it was taken over by Francis Smith, M'Murrich however retaining his interest in the

business till his death in 1847. The following letter from Napier to his co-partner illustrates the nature of the competition with which they had to deal:

"Blackwall, May 11, 1838.

John M'Murrich, Esq., Stuckgown.

My Dear Sir,

You ask me what I would advise to be done if the *Cigar* should appear on Loch Lomond.[1] Oppose her as long as she will last in a decided, straightforward, honourable manner, always keeping in view that her receipts are two or three hundred pounds a year less than her outlay. I cannot agree with your reason for reducing the fares before opposition comes on. For anything that does not form a necessary of life I think the seller is entitled to charge what he pleases, provided the purchaser knows beforehand what he has to pay. I have always found that the public studied their own immediate interests, and paid no attention to the professions of sacrifices made at former periods in their favour, and I rather think in doing so they are not far wrong. Your other reason for reducing the fares I think infinitely better, that is, that it will increase our annual dividend. If you are sure of that do it by all means. I expect to be in Glasgow for an hour or two about ten days hence; if I can possibly bring Stuckgown under my range I will do it.

I am, my dear Sir,

Yours truly,

David Napier."

[1] The *Cigar* steamboat referred to was designed and built about 1829 by Mr. Neil Snodgrass, cotton spinner, Glasgow. It consisted of two long iron tubes, each resembling a cigar in shape, connected together, with a space between them for the paddle-wheel. A wooden house or cabin was erected on the deck. This peculiar craft was tried on the Clyde for a short time but was found very difficult to manage. She ran into and sank a smack, and on another occasion "ran tilt against Port-Glasgow pier, the ends of the cigars being so driven into the wooden logs that a tug had to be applied to draw them out." Being found unsuitable for Clyde traffic, the idea appears to have been entertained that she could be employed on Loch Lomond. She was however laid aside, and, about 1840, was moored off Glasgow Green for the use of bathers, the saloon being converted into a refreshment room.

GLENSHELLISH HOUSE.

Another competitor appeared in the *Queen of Scots*, owned by Captain Lewis Maclellan, but she also ran but a short time. In 1844 the "New Loch Lomond Steamboat Company" placed their *Water Witch* on the Loch, and in the following year an agreement was made to amalgamate the interests of the proprietors concerned, Napier's steamer being valued at £1332, and that of the company at £1222. The new management also took over a contract that Napier had made for the *Rob Roy*, a small iron steamboat intended for Loch Katrine, to be built by Denny Brothers, and engined by Wingate. Napier's *Loch Lomond* was sold in 1846 to Mr. Ainslie, Fort-William, and another steamer, the *Marchioness of Breadalbane*, was ordered from Messrs. Denny. Napier about this time offered to sell his interest in the business for £1000, but this not being accepted he retained his shares till 1850, when they were bought by George & James Burns for the sum of £1600. This transaction closed David Napier's long connection with the Loch Lomond service. The company formed in 1845 carried on the service till 1889, when it was, by agreement, disposed of to the railway companies who now jointly manage the Loch Lomond traffic.

17. GLENSHELLISH

Mr. Napier's first purchase in Argyleshire was the estate of Glenshellish, situated near the north end of Loch Eck, and about four and a half miles from Strachur, on Loch Fyne. It contained about two thousand acres of arable and grazing ground, and was purchased by Napier in 1826 for the sum of eight thousand two hundred pounds. He expended about four thousand pounds additional in building the mansion-house, and in various improvements. The house—see reproduction, page 112 from a photo by Messrs. Annan—is still in use, and is described as "an exceptionally good residence, occupying a fine situation." This was Napier's summer resort, and for some years he kept the farm lands under his own management. When he removed to London the estate was leased

at a moderate rental, the lease including "the right of salmon fishing on Loch Eck and liberty to shoot game." Ultimately he offered the property to his tenant for twelve thousand pounds, but this not being accepted, it remained in his possession till his death, and was disposed of by his trustees in 1870. Napier's residence here, and his steamboat operations on Loch Eck, are recalled by four well-made paddle rings which still remain on the farm, having been turned to account as farmyard "stack stools" (see reproduction, from a photo by Messrs. Annan who discovered these wheels being thus used, opposite page 60). They are over nine feet in diameter, the arms tapered, and the centres adapted for a shaft of six and a half inches square.

18. KILMUN

Two years after acquiring Glenshellish,—1828,—Mr. Napier purchased "the land on the north shore of the Holy Loch" from Mr. Campbell of Monzie, extending from the old hamlet of Kilmun to Strone Point, and a later purchase embraced the stretch of shore ground from Strone to Blairmore, in all about three miles, the latter place being then known as Portinstuck. The original Kilmun contained but a few cottages adjacent to its ancient church. Recognising the growing popularity of coast watering-places, which the Clyde steamboats were now making easily accessible, Napier appears to have reckoned that, by acquiring the ownership of this desirable district, he would not only ensure employment for some of the river-boats he proposed to build, but be able also to protect himself from the excessive competition that already prevailed in the coast passenger traffic. He commenced operations at Kilmun by erecting some workmen's houses and a number of villas, the latter still forming the principal feature of the place. He further built a pier and the hotel, which also remain, formed good roads around the shore, and did much to improve the country road between Holy Loch and Loch Eck. Shortly thereafter he built for himself the mansion-house of Finnart-

more,[1] and used it for a number of years as a coast residence when that was found more convenient than travelling to Glenshellish. An advertisement of 1829 announced: "At Kilmun there is now a substantial quay built, where passengers can land at all times. Houses to let, ground to feu." Feuing and building operations gradually extended along the shore from Kilmun to Blairmore. In addition to the piers at these places, one was also built at Strone, and the passenger traffic was carried on by Napier's steamers *Kilmun*, *Earl Grey*, and others. At the same time the "new route to Inveraray" mentioned in the Memoir was opened up, passengers being conveyed by coach from Kilmun to Loch Eck, to the north end of the loch by the *Aglaia*, thence by coach, passing Glenshellish to Strachur, and by another steamboat over Loch Fyne to Inveraray. A number of the coast-town piers on the Clyde were at this time in the hands of private proprietors, while others were managed by local bodies who in some cases levied rates on steamboats, passengers and goods, without any legal authority having been obtained for so doing. Among those was Rothesay pier,[2] which some of Napier's boats used, and on his objecting to the payment of dues not legally authorised, the Town Council found it necessary to put themselves right by obtaining statutory powers from Parliament. Some years later,

[1] An incident characteristic of Napier may be given as communicated to the late Mr. M'Coll, Piermaster, Kilmun, by an old residenter, who, one Sunday morning in winter, on his way to church at Kilmun, overtook Napier while occupied sketching out the details of a drawing with his walking-stick on the snow by the road-side. Enquiring what was this that Mr. Napier was busy with, he replied to the effect that as an improvement on the steam-engine had suggested itself to him, he could not resist the desire to see, if possible, how it would work out practically. His drawing, he said, had now satisfied him on that point; he could now dismiss the subject from his thoughts, and would be able to give his attention, as he could not have done otherwise, to what the minister might have to say at the kirk.

[2] "The first reference to steamboats in the records of the Burgh of Rothesay is on 10th May, 1816, when it was agreed that five guineas should be accepted from each of the steamboats *Rothesay Castle* and *Dumbarton Castle* as a composition for harbour dues for twelve months, and the magistrates were authorised to make as advantageous arrangements as possible with the masters and owners of any other steamboats coming to the port" (Reid's *History of Bute*).

however, the piers question came before Napier in a reverse form, when a claim was made by certain steamboat owners that they were entitled to use the Kilmun pier without his sanction. Being then in London, he had given up the running of steamers on the Clyde, and had leased this pier to the "Castle Steamboat Company," managed by Messrs. Burns, who meant it to be used only for their own boats. This arrangement was however keenly resented by other competitors for the local trade, and for a time they persisted in making use of the pier, despite the remonstrance of the lessees. This led to what was quaintly described as "unpleasant doings," and ultimately Mr. Napier was appealed to. As it happened, one of the aggressive steamboats was owned by relatives of his own, and Napier had therefore a delicate task to deal with. His first letter being ignored, a more peremptory notice to stop the "encroachment" followed. "If I were on the spot," he wrote, "I think I could do it without putting either to much expense," adding diplomatically, "I cannot for a moment doubt that your sending the steamer to Kilmun was for the purpose of accommodating my feuars with a superior boat. I therefore beg you not to put me into the dilemma of appearing so odious as I will be by taking legal measures to prevent my tenants having the best accommodation." This stopped the unauthorised use of the pier, although it is said the steamer in question continued her traffic to Kilmun for a year or two longer, using instead of the pier a long wide gangway, mounted on wheels, which was run out into the water for the landing and embarking of passengers and goods. Another steamboat placed under the same interdict carried on its Kilmun service for some time by the use of small boats. On expiry of the lease, however, the pier was rented to a neutral collector, and in his hands became available to all comers. Some of the Kilmun houses were disposed of in Mr. Napier's lifetime, but the shore property generally, and the feu-duties connected therewith, remained in his possession till his death.

MR. AND MRS. ROBERT NAPIER.

From photo in possession of David Bell.

19. STEAM CARRIAGE

David Napier's steam carriage ran, it is understood, between Kilmun and Lock Eck in 1827 and 1828—its continued use being found impracticable owing to the difficulties referred to in the Memoir. A Kilmun gentleman who saw the carriage at work has stated that "the roads were of no account at that time, and the motor was not a success." Nothing is known as to its design, but presumably the main difficulty was in the weight of boiler and water, the great obstacle to success both before and after Napier's time. A safe and manageable road carriage had long been desired, and attempts to produce such a vehicle had been made by Cugnot in 1770; Murdoch and Watt, 1784; Symington, 1786; Fourness and Ashworth, 1788; Trevithick, 1800; Henry Bell, and others. The boiler proposed by Watt was to be "made of wooden staves joined together and fastened with iron hoops like a cask; the furnace to be of iron, and placed in the inside of the boiler, so as to be surrounded on every side with water." He, however, never built a steam carriage, and his opinion as to the strict limitation of steam pressure is well known. It is said that Trevithick's was the first road carriage to carry passengers; but Napier's was, it is believed, the first to ply regularly for hire. A patent for improvements in steam carriages was taken in 1831 by David, James and William Napier (relatives of David), but they had no greater success than the earlier inventors. The Memoir states that Napier had "again resumed the subject," but no record has been found of further experiments. "Legislation, prejudice, and the advent of the railway combined latterly to discredit the steam road-carriage, and it was finally driven off the field by the further legislation of 1861 and 1878."

The splendid success of the modern motor-car and motor-boat has, of course, been largely due to their independence of the cumbrous boiler and apparatus which the early engineers had to deal with; and Napier's anticipation that "the work done by horses, and a good deal of what is done by steamboats," would be performed by road vehicles,

is now being realised, but by petrol instead of steam. There is a certain interest in the fact that the Napiers whose auto-cars have been so very successful are descendants of the David Napier who was joint-author of the 1831 patent.

20. LANCEFIELD

The "lands called Lancefield" formed part of the estate of Stobcross, and appear to have extended from a line between the present Hydepark Street and Lancefield Street, to the western boundary of the old burgh of Anderston, between Elliot Street and Finnieston Street. In 1821 David Napier purchased the eastern portion of this land, extending from the Clyde to Graham's Mills, from Mrs. Anne Gillespie or Mitchell, wife of the Rev. John Mitchell minister of the Secession Church, Anderston, the price paid being £2700. Here he erected the extensive engine and boiler works long known as Lancefield Foundry; and on the river-side he constructed a tidal basin to accommodate vessels while receiving their machinery or undergoing repairs. "Lancefield Dock," with the lofty sheer-legs that distinguished it, formed, for many years, a prominent feature of the harbour; and it remained the only basin or dock at Glasgow till Kingston Dock was opened in 1867. At the north end he built Lancefield House (see view, page 108, reproduced from an old drawing).

Ultimately Robert Napier, who purchased the Lancefield property in 1841, sold the dock to the Clyde Trustees and it was then wholly removed in order to widen the harbour and improve the line of quay. Lancefield House was built by David Napier, and most of his family were born there. He was an office-bearer at that time in the original parish church of Anderston, and its records bear that "iron pillars made at Lancefield" were supplied, to replace pillars of wood, in connection with certain alterations of the church buildings. The plan (at end of book) shows the arrangement of the property when it was sold to his cousin, and indicates also the adjacent Lancefield

Forge of Messrs. Fulton and Nelson,—the former being a brother-in-law of David Napier. It also shows, on south side of the Clyde, the first shipbuilding yards of Thomas Wingate and of Tod & M'Gregor.

21. ROBERT NAPIER, 1791-1876

This celebrated engineer and shipbuilder was a cousin of David, and also his brother-in-law. (See portraits of Mr. and Mrs. Napier from a photograph reproduced on page 116.) Having completed his apprenticeship with his father in Dumbarton he commenced business for himself in Glasgow in 1815. A few years thereafter he extended his operations to marine engineering at the Camlachie premises which David had vacated. Business having prospered there, he acquired later the larger and more convenient Vulcan Foundry in Washington Street; and on David's removal to London, he leased, and ultimately purchased, the still more extensive Lancefield Foundry. About five years thereafter his business was further extended by commencing the construction of iron ships at Govan. He contributed materially to the formation and development of many important steamship companies, including the British and North American (now Cunard) Company; and was among the first to undertake the construction of armour-clad vessels, of which he furnished a large number to the British and other governments. In 1853 he assumed his sons, James R. and John as partners, thereby constituting the firm of R. Napier & Sons. Mr. Napier died at his residence, West Shandon, Gareloch, in 1876, in his eighty-sixth year. An excellent biography by his grand-nephew, James Napier, was published in 1904.

After the death of Robert Napier, and of his son, James R., the business was sold, and ultimately passed into the hands of Messrs. Wm. Beardmore & Co., Limited.

22. DAVID TOD, 1796–1859. JOHN M'GREGOR, 1800–1858

These well-known engineers entered David Napier's service at an early age at Camlachie ; and accompanied him thence to Lancefield Foundry. Becoming experienced workmen, they were from time to time appointed as sea-going engineers in vessels engined by Napier—Tod having occupied this position for some time in the historic *Rob Roy*, and M'Gregor's last service afloat being in the *Clyde*, a Liverpool steamer. About 1833 they resolved to commence business on their own account; and Napier, who had thoughts of removing to London, made offer to them of his Lancefield works. Preferring however to begin on a smaller scale, they started business as "Tod & M'Gregor, Engineers," in Carrick Street, Glasgow,—their first engines it is said being fitted into the *Helen M'Gregor*, a steamer that plied between Glasgow and Inverness. Within a short time the increase of business led to their feuing ground on the then open lands adjoining Anderston Quay, immediately west of Warroch Street, where they erected extensive engine and boiler works, long known as Clyde Foundry. About 1838 they commenced the building of iron ships on the south bank of the Clyde, opposite Lancefield Dock, being thus among the first to combine iron ship building and marine engineering. The river there at that time was only about 150 to 160 feet wide, and the subsequent extensive widenings of the harbour caused the site of this shipyard, and the adjoining premises of Thomas Wingate, to be wholly removed. Among the steamers built here were the *Vale of Leven*, *Royal Tar*, *Royal Sovereign*, *Royal George*, and *Princess Royal*; some of these being for Langlands' Liverpool trade. In 1844 the shipbuilding business was transferred to Meadowside, Partick, where also the firm had a large dry dock formed about 1856. They further erected two handsomely finished building-sheds, of 280 and 340 feet length respectively over the shipyard which were unfortunately destroyed by the memorable storm of February 1856, and were not replaced. After the death of the original partners, Tod & M'Gregor's business

JOHN D. NAPIER.

HYDEPARK STREET PERIOD.

From photo belonging to David Dehane Napier.

was for some years carried on by their sons; and on their retiral in 1872 the shipyard and dock were acquired by Messrs. Handyside & Henderson, the present owners being Messrs. David and William Henderson & Co., Limited.

23. BOSSUT, 1730–1814

Charles Bossut (Abbé) was a distinguished French mathematician and a writer on hydrostatics and hydrodynamics, whose works were published in 1810-12. It is said that to his researches in these subjects, and in respect to the stability of ships, were due the superior sailing qualities of the vessels of the French navy at the beginning of the nineteenth century. He also took much interest in the improvement of the steam-engine. The *Rob Roy*, built to the model suggested by Bossut's ideas to Napier, was recognised as the "fastest steamer on the Clyde at the time."

24. ARMOURED GUN-BOAT

The precise date when Napier proposed his gun-boat is not known, but till the beginning of the Crimean War (1854) armour-clad ships constructed of iron were an untried novelty; and naval guns were of comparatively small calibre. Napier's scheme outlined a vessel combining powers of attack and defence far exceeding those of any gun-boat then existing. Stevens had, before this time, suggested the protection of war-ships with armour; and in 1853 the French Government had carried out experiments in the armour-plating of wooden vessels. The results were embodied in a type of gun-boat having 4-inch plating on its sides; and the design of this vessel being communicated to the British Admiralty, the latter ordered the construction of four such craft, designated "armour-clad floating batteries," to operate in shallow waters against land fortifications. These were supplemented later by four more of an improved construction, but till this time no armour-plated *iron* ship had been built by or for the

British Government. The war then in progress suggested the advantage to be gained by having iron vessels, armoured, and carrying powerful guns; and toward the end of 1855 the Admiralty prepared plans of iron "floating batteries"—short broad vessels, protected by heavy armour-plates, which were wanted for immediate service. By dint of extraordinary exertions several vessels of this description were completed within a few months, including the *Erebus*, built on the Clyde, the *Terror*, and the *Thunderbolt*. These were distinctly different from Napier's design; but as the war had come almost to a close when they were finished no opportunity offered of testing their practical efficiency, and there was no immediate inducement to undertake further experiments. The next development in British armour-clads came three years later, when the frigates *Warrior* and *Black Prince* were simultaneously built, the former on the Thames, the latter on the Clyde.

Appendix

On retiring from Millwall, the three younger Napiers turned their attention to Australia, then regarded as the "land of promise." Setting out in 1852, they first made a brief inspection of gold-mining life, but quickly decided that their road did not lie in that direction. Their paths accordingly diverged for a number of years, but as they ultimately were again associated together in founding the important business of Napier Brothers, Glasgow, the supplementary notes that follow may be found of interest.

John D. Napier (see portrait at p. 120), fourth child and eldest son of David, was born at Glasgow in 1818, educated at the Grammar School (now High School) and University; and acquired a thorough knowledge of engineering in his father's Lancefield Foundry. His first appointment in Australia was that of manager of a Melbourne shipping business, and thereafter he accepted an appointment as superintending engineer, under the Colonial government, to carry out operations for removal of the Geelong Bar, which then formed a serious obstacle to navigation. This proved a task of much difficulty, but after two years of arduous work it was found that vessels of deep draught could be taken over one part of the Bar in safety. As private business required then his return to London, he could not see the work wholly finished; but the high appreciation of what he had accomplished found expression, before he left, in a public entertainment, and the presentation of valuable gifts.

Returning to Britain in 1855, he became assistant manager in the shipyard of R. Napier & Sons, Govan, where just then the armour-clad

vessel *Erebus* was being constructed, under great pressure, for the British Government. She was, by extraordinary effort, completed in about three and a half months, Mr. Napier going with her from the Clyde to Portsmouth and delivering her there to the naval authorities. Shortly thereafter another vessel, built by his uncle's firm for the Canadian Government, had to be delivered in the St. Lawrence; and that duty he likewise carried out successfully. He then made a lengthened tour through Canada and part of the United States, accompanied by his wife; discovering to their amusement that, from Montreal onward, rumour would have it that they were none other than "Lord and Lady Napier" travelling *incog.*

Returning to Govan, he was appointed principal manager, holding that position for over six years. Within that period the vessels constructed included the *Scotia*, last of the Cunard Atlantic paddle steamers, and the pioneer armour-clad frigate *Black Prince.* On leaving Glasgow, Mr. Napier, about 1865, was invited by the Millwall Iron Works and Shipbuilding Company to manage their "Scotch" yard, this being, practically, the same yard where he and his brother had formerly carried on their business. The difficulty remained, however, of making shipbuilding on the Thames successful; and the works had ultimately to be closed. From London Mr. Napier proceeded to Birkenhead, where for about three years he was manager of the extensive Canada Works. That position he relinquished in 1867 to join his brother Robert in establishing the firm of "Napier Brothers" in Glasgow; and he remained senior partner in that business till his death in March 1880.

In 1875 he became a member of the Incorporation of Hammermen in Glasgow, the ancient guild of which his father had been a deacon. With much of his father's energy and resourcefulness he combined great geniality and kindliness of disposition. He was much liked by those who served under him, and held in the highest regard by a wide circle of professional and private friends.

ROBERT D. NAPIER.

HYDEPARK STREET PERIOD.

From photo belonging to David Dehane Napier.

APPENDIX

Francis Napier, two years younger than John, was educated at the Grammar School and University of Glasgow. He served an apprenticeship as marine engineer in the works of Tod & M'Gregor; and it is understood that he supplemented his father's invention of the steeple engine by designing the four piston-rod arrangement. On proceeding to Australia he became partner in an engineering company in Sydney; and in 1867 he joined an expedition, organised by the South Australian Government, under command of Captain Cadell, to explore the northern coasts of its territory. His journal of this expedition was, after his death, printed for private circulation by his cousin, James R. Napier, under the title of *Australian Notes*. He returned to Glasgow, in 1871, to join the business which his brothers had established; and his ingenious invention the double-screw steering gear contributed materially to the reputation of the firm. A highly qualified engineer, and devoted to scientific pursuits, he was of a quiet retiring disposition. He died at Gareloch, Clyde, in December 1875.

Robert D. Napier (see portrait at p. 124), the youngest surviving son, was educated for a time at Liverpool, and later in London. In Australia his experience was chiefly that of marine engineering, afloat and on shore. Having invented the valuable "Differential Self-acting Friction Brake," he returned to Britain, about 1865-66, to patent and introduce this invention. Along with his brother John he established the business already referred to, and the firm was successful in applying the Friction Brake in many directions, especially in the well-known Napier Windlass. In papers submitted to the Institution of Engineers and Shipbuilders by Robert, he discussed the "Special applications of the Differential Friction Clutch," which the president pronounced "one of the best mechanical inventions that had been brought under the notice of the Institution." He carried out an exhaustive series of experiments to determine "the velocity of steam and other gases" and "the true principles of the discharge of fluids," the results of which were embodied in

further contributions to the *Transactions* of the Institution. In common with his brothers, he inherited much of their father's inventive ability; and in private life was very highly esteemed by all who knew him. He died at Glasgow in May 1885.

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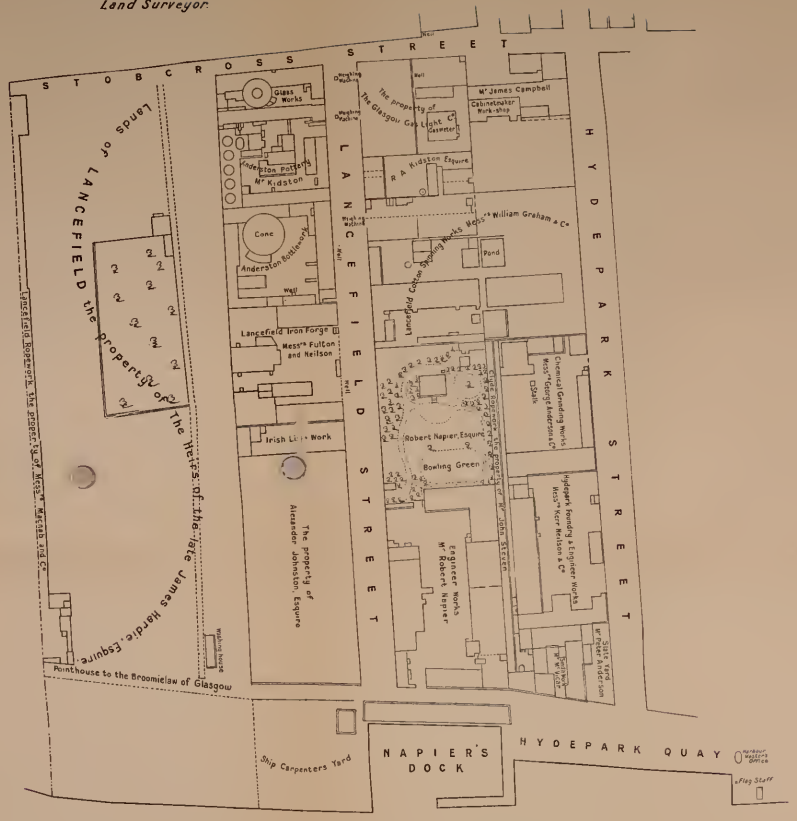
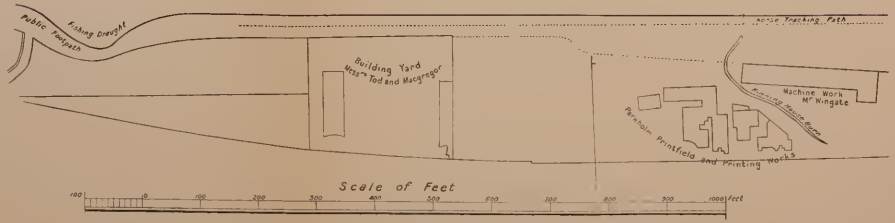
Glasgow 15th August, 1840
And.w MACFARLANE,
Land Surveyor.





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